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THE MENACE OF SOIL EROSION.

In a series of recent articles*, Mr. T. Eden, Agricultural Chemist to the Tea Research Institute of Ceylon, has performed a great service to tropical agriculturists in again forcibly stressing the menace of erosion in relation to the general question of the maintenance of soil productivity. "The opening of large tracts of land in Canada and the United States for wheat and cotton culture, and the rapid increase in the spread of large-scale estate agriculture under coffee, tea and rubber in the Colonial Empire, has brought the problem particularly into prominence. In these regions, the last half-century has witnessed an extensive exploitation of agricultural wealth with relatively little attempt to conserve capital in the form of soil". Whilst long ago in Japan, traditional practice, strengthened by an appreciation of scientific principles, had resulted in effective anti-erosion measures, it is only in the last decade that the true significance of soil erosion has been realised in other countries. Thus, in the United States, it has been estimated that 11 million acres of farmland have been abandoned in recent years owing to permanent damage by soil erosion, and that the productivity of upland farms has decreased by seven to ten per cent. from the same cause. In those regions where widespread erosion has removed the surface soil, downward water percolation is diminished and surface run-off is enhanced, so that floods may occur in rainy weather. Springs and wells consequently dry up owing to the permanent lowering of the water-table, and serious water shortage may occur during periods of drought. The silting up of conservancies and reservoirs by transported soil material furnishes another menace, and a similar process affecting rivers results in the reduction of navigable water-courses, and in the disturbance of irrigation schemes.

Soil erosion is mainly caused by the agency of water, although in desert regions, wind may produce very similar results. Water erosion is either slow and even, affecting large tracts of land, or it is rapid and localised, producing gullies and ravines. The extent of erosion is not simply correlated with total rainfall, but rather with rainfall intensity and frequency. Where the amount of effective rainfall is high, surface run-off

*(1) Imperial Bureau of Soil Science; *Tech. Communication*, No. 23, 1933.

(2) *The Tea Quarterly*; 1933, Vol. VI, pp. 76, 111 and 145.

depends largely on the nature of the soil cover. In this respect, forest land is markedly different from agricultural land. Some average figures, quoted by Eden, strikingly indicate the difference. For forest land, the maximum run-off, expressed as a percentage of the total rainfall, is only 2.8, and for natural pasture, 7.2, whereas for small-grain, corn and pasture-seeded land it may reach nearly 27 per cent. Land carrying annual crops are especially subject to erosion, because, during part of the year, they are virtually devoid of cover. Where the crop is widely spaced and planted on ridges, erosion is particularly rapid. Numerous experimental results have been adduced to demonstrate that the most efficient way of diminishing soil erosion is the provision of a close vegetation cover.

The effect of forest growths in soil conservation was attributed solely to the interception of beating rain, but recent investigations have proved that the main protection lies in the particular properties of undecomposed forest litter. This material possesses a water-holding capacity often as great as eight times that of soil, so that a thick layer of forest débris may absorb a large proportion of the rainfall, which it exudes slowly and regularly without producing serious erosion. Even when completely saturated with water, forest litter may further reduce surface run-off by preventing the silting up of the pore spaces of the underlying soil. The natural crumb structure of the soil is thereby preserved, and downward percolation of water is encouraged. Prevention of the development of silt-pans and clay-pans may indeed be a more important factor in soil conservation by forest litter than the absorption effect. A comparison of the rates of water percolation for soil covered with undecomposed litter and similar soil under agricultural treatment shows the great superiority of the forest soil, in which the percolation rate may be fifty times as great in the surface inch layer of soil, although the difference diminishes somewhat at lower depths.

The relationship between water run-off, rate of soil erosion and surface gradient has been critically investigated. In a series of trials discussed by Eden, it was demonstrated that, for bare soil surfaces, differences in gradient tend to become less important in relation to run-off when rainfall intensity is high. Gradients varying from 6 to 23 per cent. showed no appreciable difference in amount of run-off under rain intensities exceeding the maximum rate of percolation of water through the soil, but the effect on erosion is quite the reverse. Whereas run-off increases very little for gradients above four per cent., soil erosion, though moderate in amount for gradients below four per cent., increases very rapidly for steeper slopes. Erosion also increases greatly for the higher gradients as rainfall intensity increases. Thus, doubling the rainfall intensity may increase surface run-off by only 15 per cent., but it may increase the degree of erosion by 143 per cent. for sandy-loam soil unprotected by a cover of vegetation.

Authorities differ as to the effectiveness of cultivation in soil erosion. Whilst one group asserts that tillage accelerates erosion, the other holds that operations such as ploughing, by increasing pore space and percolation, diminish loss of surface soil during rains. Unfortunately, none of the recorded examples takes into consideration the effect of the subsoil, so that further experimentation is needed before either of these opinions can definitely be accepted.

So many specific soil properties and attributes are involved in determining erosibility, that, at the present time, no very exact generalisations can be propounded, although many valuable investigations have been prosecuted on this important problem, notably by the staff of the United States Bureau of Soils. Whilst no single soil factor or physical constant can be completely correlated with erosibility, the results of critical studies indicate that percolation capacity at least bears an important relationship with resistance to erosion. Percolation, in turn, is decided by many physical soil properties, such as structure and texture. Thus, tropical red earths, whose chemical composition indicates a low silica alumina ratio, are notoriously porous and free-draining, as well as poorly dispersed when in suspension in water, properties which appear to confer on them a marked resistance to erosion. Such soils are the products of weathering of certain rocks under climatic conditions of extreme wetness, and their characteristic behaviour fortunately is well suited to the maintenance of stability under all conditions of rainfall, except perhaps sudden and intense tropical storms. As regards other types of soils, a high degree of dispersion, by encouraging the silting-up of the pore-spaces, and a high water-holding capacity, usually accompanied by a marked tendency to swell when wetted, may both diminish the rate of percolation, and so lower the resistance of the soil to erosion. Many discrepancies arise, however, when these simple rules are widely applied to different types of soils under different conditions of rainfall and surface gradient. The main reason for the discrepancies appears to lie in the varied relationship which the topsoil bears to the subsoil, for the soil profile is usually not homogeneous throughout, and its physical properties frequently indicate sharp changes between successive layers at different depths, which may predispose the soil to surface slip when waterlogged.

The removal of plant nutrients by erosion of surface soil is the main cause of impoverishment which eroded areas generally suffer. The largest losses are usually due to the removal of surface soil organic matter which contains the chief store of nitrogenous substances, and frequently also, abundant mineral matter fixed in humic residues. Where the soil profile is uniform in composition throughout (as in the case of certain loess soils), the removal of large quantities of material by erosion may scarcely affect the mineral nutrient status of the soil. The fertility of alluvial silt

soils representing material eroded from hill slopes, is often notoriously high, particularly in the humid tropics.

Three general methods of combating the menace of soil erosion emerge from broad considerations of the problem and from accumulated local experience. They are:—(*a*) the provision of an adequate ground cover of vegetation; (*b*) the levelling of land, and (*c*) the construction of barriers that diminish the velocity of the run-off water.

The retention of litter and mulch offers the simplest solution of erosion problems under highly intensive systems of estate agriculture with perennial tree crops, such as rubber, coffee, tea and cacao. Employed in conjunction with terracing, bunding and contour planting, either of the crop itself or of supplementary green manure crops, the method assures a high degree of soil protection. To quote Eden, "the natural bias in favour of clean weeding is slowly breaking down, and it may be that present world economic conditions will do as much as scientific propaganda to bring about a cessation of clean weeding". On the other hand, a properly controlled cover-crop can be just as effective in minimising erosion as the rank growth of vegetation usually so distasteful to the estate agriculturist, and it may have the advantage of supplying abundant nitrogen and of fixing mineral nutrients through its decay and humification.

On grass land, controlled grazing is highly important in preventing losses due to soil erosion, overgrazing having a cumulative effect, and gradually resulting in the complete removal of cover with concomitant pulverisation and exposure to washing of the surface soil.

Terracing and bunding furnish reliable preventative methods against erosion in situations where the provision of a complete vegetation cover is impossible. The main objection to these operations is their high cost and the obstruction they oppose to large-scale mechanical cultivation.

REVIEWS.

Plant Parasitic Nematodes and the Diseases they cause.

By T. Goodey. *Methuen & Co., Ltd., London* 1933, pp. XX + 306, 136 Figs. *Price*: 21*s*.

In this important book the author's aim is to present in concise form the salient facts concerning all the known nematode parasites of plants. In addition, species of partially or doubtfully parasitic habit, some saprophytes that may invade diseased plant tissues, and a few predators are briefly considered. The strictly parasitic species are treated in considerable detail, in all aspects of their systematics, morphology, bionomics and geographical distribution, and of their effects on their host plants, of which exhaustive lists are given. There is, unfortunately, little information about the economic status of the parasites, but there are adequate accounts of control measures. A short introduction deals with general morphology, classification and technique. There is a chapter on biological races in *Anguillulina dipsaci* (Kühn) and *Heterodera schachtii* Schmidt, in which species there appear to be unspecialised polyphagous races, and races more or less restricted in the number of their hosts—a matter of practical importance, especially in control by rotation of crops. The bibliographies are extensive though, in order to save space, not exhaustive. The illustrations, arrangement and printing are good. It is unnecessary to stress the value of so complete and authorative a book.

In the nomenclature adopted by the author there are many changes from old and familiar names. The three genera to which most of the thirty-one species of obligate parasites belong are *Anguillulina*, which replaces the better known *Tylenchus*; *Heterodera*; and *Aphelenchoides*, in which are included most of the species that have usually been referred to *Aphelenchus*. *Heterodera marioni* (Cornu) replaces *H. radicicola* (Greeff) for the root-knot nematode, and *Tylenchus hordei* Schφyen, of root-galls of barley and other grasses, becomes *Anguillulina radicicola* (Greeff).

Nearly half of the strictly parasitic species have been reported from the tropics. Among those of special interest to the tropical agriculturist are *Anguillulina angusta* (Butler), the "rice nematode" in India and Malaya, and the cause of "Ufra" disease in India; *A. similis* (Cobb), the "burrowing nematode", *A. pratensis* (de Man) and *Heterodera marioni* (Cornu), the "root-knot nematode", each of which has a wide distribution and a long list of host-plants, including many tropical crop plants; *Tylenchulus semi-penetrans* (Cobb), the "citrus root nematode", which attacks only citrus trees, probably in all countries where they have been grown for a long time; *Aphelenchoides cocophilus* (Cobb), occurring in the West Indies and Central America (and Fiji?) and the cause of "red ring" disease of the coconut palm.

A. M. A.

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Nature Teaching.

By Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S., pp. 216. London. *The West India Committee*, 3*s*. 6*d*. net.

The sixth edition of this popular book, primarily written for the guidance and information of the elementary and secondary school teacher, has just been published. It can be obtained from the Secretary, The West India Committee, 14, Trinity Square, London E.C. 3.

CROSS BREEDING FOR MILK.*

BY

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THE town dairyman in India requires for his business a good milch cow which will calve regularly and if possible, milk without its calf. He draws for this purpose on the breeding tracts of country districts taking the pick of the cows therefrom. In Madras the Ongole breed is considered to be the best milker for dairy purposes, the average yield being between 2,250 and 2,500 lb. Young cows in milk are purchased and brought into town and in many cases, when these cows go dry, they are sold to the butcher and thus are lost to the country. The town milkman moreover usually neglects to feed his heifer calves properly, so that the towns are apt to become a serious drain on the country breeding tracts.

The problem is probably poristic, but one possible solution suggested by Carruth was thought to be the evolution of a new breed specially suited to urban needs by using an Ayrshire bull on local Scindhe and Saniwal cows. The first generation half-bred bull is used on the first generation half-bred cow, the second generation bull on the second generation cow and so on. Thus the evolved breed always retains half the imported blood and half the indigenous blood.

This experiment was begun in 1919 and until 1923 it was conducted at the Military Dairy Farm at Bangalore. Early in 1923 the Madras Government acquired 32 half-bred cows and heifers from the resulting herd and continued the work on their own cattle farm at Hosur. During the course of the work in Madras 222 calves have been born. All except the F.1 generation were weaned at birth. The calves were classified as follows:—

Generation.	Heifers.	Bulls.	Total.
F.1	15	12	27
F.2	27	33	60
F.3	43	54	97
F.4	13	22	35
F.5	3	—	3
Total ..	101	121	222

The death rate was rather heavy. Improper feeding of the calves caused stomach trouble, in some cases followed by pneumonia. The total mortality was 106, the chief causes of death being :

Johnes disease	 6
Pneumonia	21
Rinderpest reaction	....18 (including calves used as controls.)
Enteritis, &c.	19
Blackquarter	 5
Pyroplasmosis	 4

The calves of the second and third generation did not grow as well as those of the first generation. This was partly due to difficulties in hand-feeding, work which, with a limited staff, it is difficult to supervise, and which must be left to a great extent to attendants with insufficient knowledge and training. Feeding of milk at the wrong temperature to young calves is very apt to cause scouring, from which animals are slow to recover. Ringworm also proved troublesome, resulting in retarded growth.

Irregular breeders and poor milkers were from time to time eliminated from the herd while adult bulls were used for work purposes and a large number of superfluous bull calves were sold. The total strength of the herd at present is :—

Generation.	Cows and heifers	Breeding bulls and young bulls.	Heifer calves.	Bull calves.	Total.
F.1 ..	6	2	—	—	8
F.2 ..	5	4	1	—	10
F.3 ..	17	3	2	—	22
F.4 ..	4	4	1	3	12
F.5 ..	—	—	1	—	1
Total	32	13	5	3	53

28 F.1 cows calved at an average age of 2 years 7 months and 20 days; 27 F.2 cows at 3 years and 16 days; 12 F.3 cows at 3 years 2 months and 1 day; and 2 F.4 cows at 3 years and 1 day.

Milk Yields.

The average number of completed lactations per cow in each generation is shown below :—

Generation.	All Animals.	Herd excluding poor milkers, &c.
F.1	3.6	4.0
F.2	3.5	3.9
F.3	2.4	2.5

It will be seen that the F.1 and F.2 generations have reached their best, while the F.3 have not yet done so. In order to have some standard of comparison a herd of 15 Scindhe cows were maintained alongside the cross breds. These were specially selected from a large herd for their milking qualities. The following statements of milk yields includes (*a*) all cows born in the

* *See* also *The Indian Journal of Veterinary Science and Animal Husbandry*, Vol. III, pt. 4.

CROSS BREEDING FOR MILK.

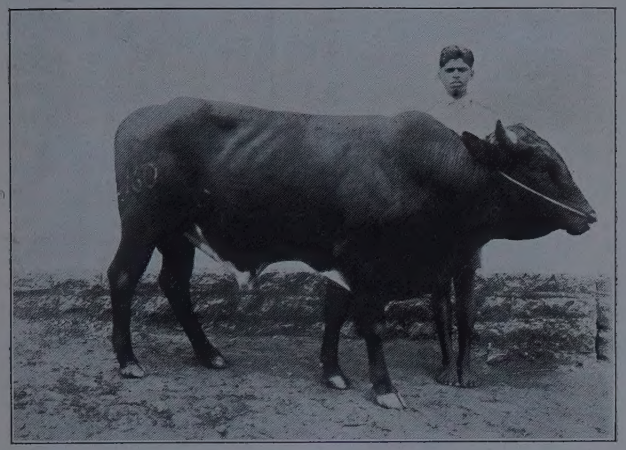

FIG. 1.—*F1 Generation Bull.*

FIG. 2.—*F2 Generation Bull.*

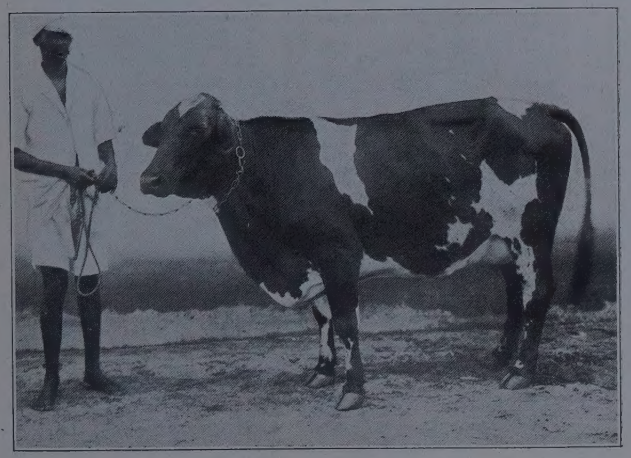

FIG. 3.—*F1 Generation Cow.*

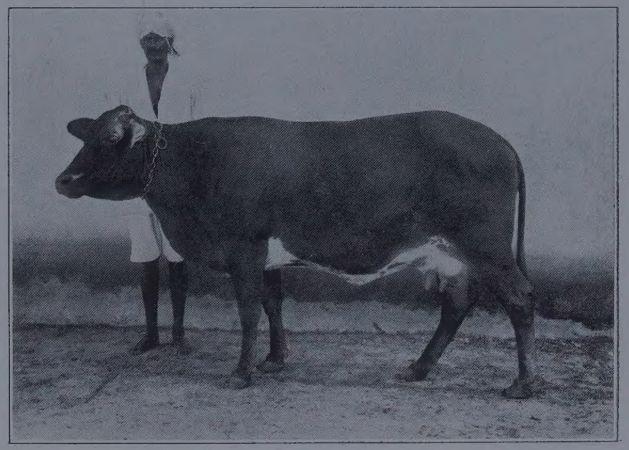

FIG. 4.—*F2 Generation Cow.*

CROSS BREEDING FOR MILK.

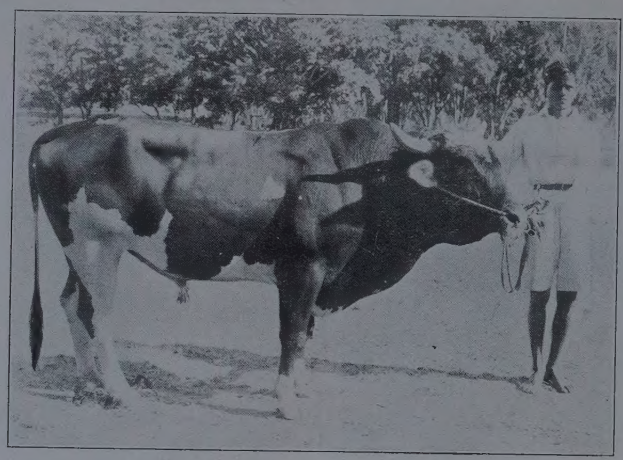

FIG. 5.—*F3 Generation Bull.*

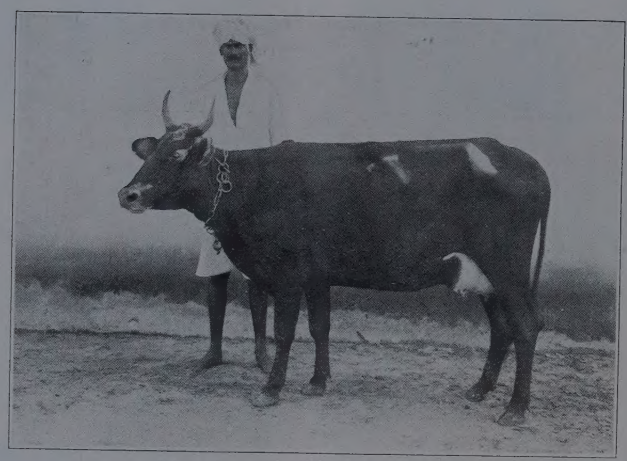

FIG. 6.—*F3 Generation Cow.*

FIG. 7.—*F4 Generation Cow.*

experiment and (*b*) for comparative purposes, excludes poor and abnormal milkers, and animals with exceptionally long dry periods :—

Class	Average yield per lactation. (lb.)	Average daily average. (lb.)	Average days dry.	Average maximum yield. (lb.)
15 Scindhe cows ..	3,431	12.0	186	4,505
27 F.1 cows..	5,021	14.8	113	6,268
23 F.2 cows..	3,296	12.3	151	4,247
11 F.3 cows..	3,626	12.4	148	4,516

Class.	Average yield per lactation. (lb.)	Average daily average. (lb.)	Average days dry.	Average maximum yield. (lb.)	Average number of days in milk.
15 Scindhe cows	3,431	12.0	186	4,505	286
23 F.1. cows ..	5,122	16.1	83	6,231	312
19 F.2. cows ..	4,068	14.0	97	4,919	290
9 F.3. cows ..	4,151	13.3	94	4,550	304

In the F.3 group above two cows in their first lactation gave 1,100 lb. of milk and two cows were dry for 272 and 349 days respectively. These have been omitted from the records.

The average daily yield from the date of first calving to that of last calving including dry periods for all the herd was :—

Scindhe cows	7.2 lb.
F.1 cows	12.7 lb.
F.2 cows	10.5 lb.
F.3 cows	10.4 lb.

Cross bred cows thus gave on the average 3 to 5 lb. more milk per day from the date of first calving to that of last calving. The F.3 cows are not yet at their best, being still young.

F.1 Herd.

In the F.1. herd three cows had extraordinarily long lactations and two aborted after being six months in milk. Only three out of a herd of 23 cows have yielded less milk on the average per lactation than the Scindhes with which they were compared. The highest yield in a single lactation was 9,732 lb. with a daily average of 28.9 lb. This cow in seven lactations averaged 6,574 lb. with a daily average of 21.7 lb. Another good animal had an average for eight lactations of 5,885.6 lb. with a daily average of 18.1 lb. She gave 50.5 lb. of milk per day at her maximum. One cow had abnormal lactations and aborted on two occasions after being six months in milk. She gave 12,731 lb. in 950 days with a daily average of 13.4 lb. and 10,820 lb. in 894 days with a daily average of 12.1 lb. After a difficult parturition at her second calving she became sterile. Another cow aborted about seven months after calving and she also had an abnormal lactation giving 17,092 lb. in 810 days with a daily average of 21.1 lb. Apart from these abnormalities 50 per cent. of this F.1 herd have given over 6,000 lb. per lactation and on the whole it is much superior to the Scindhe herd with which it was compared.

F.2 Herd.

On the whole the average yield per lactation of this group is less than that of the Scindhes, but if four low yielders are eliminated the average yield for the remaining 19 cows is 637 lb. more than that of the Scindhes, a daily average of 14 lb. as against 12 lb. If the daily average yield from the date of first calving to that of last calving is considered, the F.2 cows averaged 10.5 lb. as compared with 7.2 lb. of the Scindhes, an increase of 3.3 lb. per day per cow. Four cows yielded over 6,000 lb. in a lactation and five between 5,000 and 6,000 lb. The best yield in four lactations averaged 6,773 lb. with a daily average of 18.4 lb., the highest lactation producing 8,380 lb. with a daily average of 18.1 lb. Another cow averaged in six lactations 4,920 lb. with a daily average of 16.7 lb. On the whole nine cows out of 19 have yielded over 5,000 lb. and 14 have exceeded the average of the Scindhes with which they were compared.

F.3 Herd.

These animals have not yet reached their maximum. Taking the whole herd of 11 cows into consideration the average yield is greater than that of the Scindhes by about 200 lb. If the poorest milkers are eliminated the average yield per lactation for nine cows is 4,151 lb., slightly better than the F.2. herd and 720 lb. better than the Scindhes, the total average being 13.3 lb. as compared with 12 lb. Two cows in this herd have yielded over 6,000 lb. in a lactation and six out of the nine have exceeded the average yield of the Scindhes. The best performance was an average of 5,702 lb. for five lactations with a daily average of 15.2 lb., the highest yield being 6,825 lb. with a daily average of 15.3 lb.

F.4 Herd.

This herd is still very young and only two cows are in milk. One gave 4,108 lb. in her first lactation with a daily average of 10.8 lb. After being dry for 82 days she has calved again and is now giving 20 lb. per day. The other cow has yielded 4,034 lb. with a daily average of 11.3 lb. and is still in milk.

Dry Periods.

The following table shows the dry periods in the different herds.

Herd.	No. of cows.	Dry period in days
Scindhe ..	15	186
F.1	23	83
F.2	19	97
F.3	9	94

There is here a marked difference, the Scindhes being dry on the average for three months more than the cross-breds.

Weights.

F.1 calves are allowed to suckle their dams and consequently grow more quickly than the F.2. and F.3. calves which are hand-fed. When the latter go on to ordinary rations they appear to fall off for a few months and do not improve until they are a year old.

The average weight of calves at birth are :—

Generation.	Bull calves. (lb.)	Heifer calves. (lb.)
F.1	52	51
F.2	59	49
F.3	54	46
F.4	49	48
F.5 (2) ..	—	48½

For cows over four years of age the average weights and heights are : —

Generation.	Weight (lb.)	Height at withers. (inches)	Girth. (inches)
F.1	859	47½	67½
F.2	750	46½	65
F.3	701	45	63½
F.4 (2 cows) ..	755	43½	61

Both height and girth decrease with succeeding generations and the animals appear to be reverting towards the size of the Scindhe dam.

In many cases the coats of F.2 and F.3. cows are rough and they have tight skins, disadvantages in a hot climate but these defects disappear as the animals grow older. At Hosur, ringworm has been very troublesome of late years and animals attacked by this disease become severely run down and take a long time to recover. The half bred calves are not pampered. They are fed on the same lines as country calves and young stock and if they cannot survive, are allowed to go under.

Adult cows on the whole look well, they are not too big and are about the right size for the small dairyman. The bulls are disappointing, the chief fault in the F.2 and F.3 animals being a weakness in the hindlegs . When viewed from behind their hocks almost touch one another. The forepart is generally good with a strong neck and good chest capacity although in some cases they appear to fall away behind the shoulder. Almost all cross-bred bulls are very quick and good at service.

Colour.

The colours of each generation are generally as follows :—

F.1 are black, dark-brown, black and white, and occasionally brown and white and brindle.

F.2 are mostly reds, light brown and red and white.

F.3 and F.4 are light red, red and white with occasional fawns and black and white. Most of them have smooth coats when adults.

Disease Resistance.

Experience during the past twelve years has shown that half-bred cattle stand up to foot and mouth disease quite as well as country cattle. As regards rinderpest there is not much to fear provided that the animals are regularly inoculated as calves and re-inoculated at three years old by the "Serum Simultaneous" method. Some of the cross-bred calves have died from rinderpest reaction, while others used as controls have survived. As calves the cross-breds appear to suffer from stomach troubles. This is probably due to faults in hand feeding. In Western countries a stockman or labourer takes a pride and interest in his animals but this class of labour is not yet available in India, though it is hoped that with better training and more supervision a higher standard may be reached in the near future.

The cross-bred is not so liable to develop udder trouble as the pure Scindhe.

One defect among the half-bred cows is that many of them do not conceive at the first or second covering, although their dry periods are much shorter than those of the indigenous cows.

Breeding back to the indigenous animal with indigenous sires.

During the last six years an experiment has been conducted at Hosur with the object of producing quarter-bred Ayrshire, Scindhe and Saniwal. A Scindhe bull was used on cross-bred cows. Two of these quarter-bred cows have yielded over 5,000 lb. per lactation.

In 1930 the Madras Government purchased 16 quarter-bred Ayrshire Saniwal cows and heifers from the Pusa herd. One of these has given 8,570 lb. with a daily average of 19.9 lb. and in her present lactation has given 13,537 lb. with a daily average of 25.2 lb. This is a better yield than has been obtained from any of the half-breds.

Conclusions.

The essence of success in any cross breeding experiment is to work on a large scale. At least 200 F.2 cows are needed if a good herd is to be selected. Probably not more than 25 or 30 per cent. would be retained and the same applies to future generations.

The experiment outlined above has been handicapped throughout by being on too small a scale. This rendered drastic discarding impossible and only the very poorest of the milkers and breeders could be eliminated; but even so three cows out

of nine in the F.3 generation gave over 6,000 lb. of milk in a lactation, and another would have done so had it not unfortunately died.

The bulls under the conditions of the experiment are admittedly disappointing. Few could be used for breeding purposes. The cross-bred bull has hardly any hump and in most cases no hump at all. For this reason the ryots do not like them as working cattle, though on some of the Government Farms they have been worked quite satisfactorily. They would probably, however, suffer from the heat in the plains.

The cross-bred cows and heifers cannot stand up to the semi-starvation ration so often served out to them in India and keep fit like the indigenous breeds. They are all right so long as they are fed and housed well, and naturally a good milker pays for this. Cross-breds seen in the districts in the hands of land-owners have not the same bloom or appearance as those on the Government Farms.

The cross-bred herd has maintained the milk supply at the Agricultural College Dairy, Coimbatore, for the last nine years, and the cows have more than paid for their keep.

The number of cross-bred cows in Madras City has increased considerably during the last ten years and dairymen will rarely part with a cow or heifer possessing the least sign of imported blood in it. Moreover, though the feeding of indigenous calves is neglected, it is rare to see a cross-bred heifer calf in poor condition. These facts speak for themselves, and the opinion held by the dairyman who has to make his living out of the industry carries considerable weight, which is in favour of the cross-bred cow.

The experiment has now been abandoned owing to the necessity for economy. The result appears to show that it is possible to evolve a half-bred race of milk cows for Indian Urban districts but it will be expensive as large herds must be maintained for selection. Probably a better solution of the problem would be to breed back on cross-breds of the indigenous breed by the use of good indigenous sires from selected milkers. Calves possessing one quarter or one-eighth imported blood resemble the indigenous animals. They have humps and their size, conformation and coats are better while the heifers appear to be more thrifty feeders than the half-breds.

ARABICA COFFEE.*

Although the definite cycle of physiological activity in the coffee plant has important bearing on cultural operations and the time at which they should be performed, it is often ignored. The subject is, however, discussed by A. J. Wakefield in a pamphlet where the various seasonal activities of the plant for medium altitudes in the Northern Territory of Tanganyika, together with the cultural and protective measures appropriate to the season, are graphically presented on two large charts which can be easily modified to suit other districts. Periods of active root growth of surface feeding roots occur in the drier months, January to March and June to October. Cultivation during these months is liable to destroy the surface rootlets, resulting in nitrate starvation and disturbance of the normal balance of the tree. Deep planting to avoid borer attack does not achieve its object and may lead to nitrate starvation, since heavy rains and the water-logging of the pits result in denitrification, and the later production and location of nitrates will occur mainly in the few inches of topsoil well above the root system of the too deeply planted bush. Owing to the surface feeding root system, deep rooted cover crops are advised, such as *Dolichos Hosei*, *Indigofera endecaphylla*, *Centrosema*, *Plumieri* and *Pueraria phaseoloids*. They should not be turned in. With young coffee annual cover crops may be turned in if beyond the existing rootspread. Manures should be applied just before root activity begins and the carbohydrate nitrogen balance must be kept in mind. Heavy nitrogenous manuring has been known to suppress flower bud formation. Pruning should be done soon after flowering to allow the bearing wood as long as possible to mature for the formation of flower buds. It is noted that a vigorous annual-bearing coffee plant has little need for pruning but can be sufficiently treated by 'handling' when the crop is on, *i.e.*, pinching off the very young superfluous shoots. The possibility is discussed of checking biennial bearing by heavy nitrogenous manuring in the off year or by heavy pruning to prevent the formation of carbohydrates. The relation of soil moisture to flowering is outlined. If moisture is given before the flower bud or spike is sufficiently mature, it may cause the flower to open and drop. Irrigation for established plants should be delayed as long as possible. On young coffee early irrigation might be used to cause blossom drop and so save the cost of stripping. Intermittent flowering is hypothetically attributed to an insufficient nitrate supply preventing the development of all the buds at one time. As more nitrate becomes available later these dormant buds develop and produce a second flowering. The application of a nitrogenous fertilizer four to six weeks before the flower buds appear externally is suggested as a possible remedy for intermittent flowering. The pamphlet closes with some remarks on pests and diseases. There are some interesting diagrams of coffee root systems showing the reactions of rootgrowth to various soil conditions and cultivation practices.

* Arabica Coffee: Periods of Growth and Seasonal Measures. A. J. Wakefield. *Tanganyika Territory Dept. Agr.* Pamphlet 9, 1933, p. 16. *Horticultural Abstracts*, Vol. III, No. 4.

WEST INDIAN NOTES.

(Compiled by the Advisory Department, Imperial College of Tropical Agriculture.)

The Fruit and Vegetable Industry.

Shipments during the past quarter under review, from December to February have been virtually restricted to end of season orange and grapefruit shipments from Dominica and a few shipments of bananas from St. Lucia and Dominica to Canada and the United Kingdom.

Dominica orange shipments for the season to the end of January totalled 5,419 crates not including inter-island trade, an increase of over 2,000 over the 1932-33 crop, and of these about two-thirds were sold in the Canadian Maritimes and one-third in Bermuda. Prices have been generally remunerative.

Like previous seasons the Canadian grapefruit market was low, both as regards price and demand during the latter part of November and December. As a result, in addition to increasing juice manufacture, about 1,000 crates were sent to the United Kingdom, but the returns for this fruit, which arrived on a poor market, were very unsatisfactory, particularly in view of the high freight and selling charges. Dominica grapefruit shipments for the season to the end of January totalled 5,404 crates, as compared with the 1932-33 crop of 3,535 crates; in reality the crop increase is even greater than is shown by these figures since a fair amount of fruit has been utilised for juice manufacture.

Citrus shipments from St. Lucia have been negligible but the first commercial shipments of fruit from the young trees planted in the past few years have been made. The citrus position was helped considerably by the citrus freight rebates agreement entered into in December by the Dominica shippers with the Canadian National Steamships.

In the fresh lime trade the end of the year showed a further decrease from 7,632 to 5,144 barrels in annual exports to the United States from Dominica. St. Lucia maintained its 1932 export figure of around 3,000 barrels. There have, as usual at this time of year when limes are scarce, been many enquiries recently for fruit but shipments have been necessarily limited.

Relatively few tomatoes are being grown for export this year in Montserrat, Nevis and St. Vincent. The total crops will probably only amount to around 3,500, 600 and 600 crates respectively. Since it has proved generally uneconomic to compete with the Bahamas during the main crop period extending from the New Year until the middle of March most of the planting has been for late season. Owing however, to the liability to drought during the dry season, particularly in the Leeward Islands, this planting is in most cases largely a gamble. Latest advices from Montserrat are that high winds and drought are seriously affecting the crop.

Shipments of bananas during 1933 from Dominica and St. Lucia amounted to 22,304 and 21,997 bunches respectively, including inter-island trade. The former island shipped the largest proportion to the United Kingdom and the latter to Canada. Grenada also shipped several thousand bunches.

The banana prospects are now considerably brighter. The Canadian Banana Company has recently offered to purchase from Grenada, St. Lucia and Dominica over a five-year period the total island production of Gros Michel bananas, seven hand ($\frac{1}{2}$ count), eight hand ($\frac{3}{4}$ count) and count bunches with option to purchase six hand ($\frac{1}{4}$ count) bunches, at a price of 50 cents per count bunch delivered wharf.

In order to proceed with negotiations steps have been taken to form Banana Associations in St. Lucia and Dominica which will be given sole powers to export Gros Michel bananas by law. It is proposed that these Associations should function primarily at the port of loading, the fruit being mostly purchased by a few dealers authorised by the Association and operating with a small commission, reserving to members and non-members the right to deliver and receive payment on the wharf. In St. Lucia and Dominica it is of necessity primarily a peasant crop but in Grenada where it is more an estate question the control of the crop has been obtained by contracts direct with the estate owners, the Canadian Banana Company working through a local agent, whereas in St. Lucia and Dominica it is proposed that the local Associations should act as agents. Trinidad, which has recently been making shipments to England is probably also accepting the same contract and it is proposed there to operate under the control of a Government Board.

To meet the shipping requirements the cold storage space of the "Lady" boats of the Canadian National Steamships is being altered to give two large chambers with adequate air circulation and one small still air chamber for general fruits, &c., instead of the previous equipment of four still air chambers. It is anticipated that additional banana carrying space will be necessary in the near future to meet requirements. Shipments have been discontinued during the space alterations but it is expected to resume shipments about the end of March, and very soon afterwards shipments of at least 6,000 stems on each fortnightly boat should be made from the islands mentioned.

* * *

Banana Industry.

The low prices obtainable for agricultural products grown in the West Indies during the last few years have led to examining the possibilities of growing alternative and more lucrative crops. In consequence of this there has been a considerable increase in banana cultivations in Trinidad, Grenada, St. Lucia and Dominica; trial shipments of the fruit have been made to England and Canada, and recently, more or less regular small shipments have been dispatched on a commercial basis.

One of the greatest difficulties at first encountered was the absence of proper transport facilities both to the United Kingdom and Canada. Some of the ships were not fitted with proper cool storage, and those that were, and would undertake to carry the fruit took too long to reach their final destinations so that the fruit suffered in transit.

It is hoped that the transport difficulties have now been removed. Encouraged by the possibilities of greater development of the industry, the Fyffes' Line have now undertaken to transport up to 2,000 bunches of fruit every fortnight from Trinidad to England, and the Canadian National Steamships have arranged, as a preliminary, to provide each of the "Lady" boats with 13,300 cubic feet of cool air space by the middle of March. The period of the contract with the Canadian Banana Company, a subsidiary of the United Fruit Company, to which reference has already been made, may be extended by a period of not less than two years or not more than five years at the option of the Company. The growers are not bound to plant any definite areas with bananas, or to supply a minimum number of bunches, but any Gros Michel bananas intended for export must be offered to the company.

In Grenada the growers have accepted the terms, contracts have already been signed, and the first shipment under the agreement is being made on 23rd March. In St. Lucia and Dominica the matter is still under consideration, and it is hoped that satisfactory agreements will be forthcoming. At meetings of the Agricultural Societies in St. Lucia and Dominica held at the end of February both of which were attended by the Commissioner of Agriculture and Mr. Sanderson, Deputy Manager of the United Fruit Company in Jamaica it was unanimously decided to form a Banana Producers' Association, and to ask the Government to adopt legislation to give the Association the sole right to export bananas from the island. Such legislation is essential if the full co-operation of the growers is to be obtained.

* * *

Cotton.

Nevis.—A bonus of 3¼ cents per lb. of seed cotton has been paid by the Government in Nevis to peasants who brought their cotton to the Government Ginnery last year. As the advance made at the time of ginning was three cents per pound the total payment for the crop amounted to 6¼ cents. The present crop is fairly promising, but the rainfall has been rather excessive.

The West Indian Sea Island Cotton Association has agreed to make a contribution towards the cost of exhibiting fabrics made entirely from West Indian Sea Island Cotton at the British Industries Fair. The name of the stall will be "West Indian Sea Island Cotton". The main cost is being borne by the Fine Cotton Spinners' and Doublers' Association Limited of Manchester who are the manufacturers of the yarn from which the fabrics were made, but not the manufacturers of the fabrics themselves. The Cotton Association is therefore extremely fortunate in being offered such generous support.

Pink Boll-Worm.

The Commissioner of Agriculture has received a letter from the Director of Agriculture in Barbados which states that in spite of a vigorous clean up and a four months close season there is considerable infection by Pink Boll worm in the present crop. It is therefore suggested that a careful investigation should be made with regard to the incidence of this pest in the various cotton growing islands during the present season, so that the situation may be discussed at a future meeting of the *West Indian Sea Island Cotton Association.*

* * *

Cassava Starch.

An inquiry has recently been received through the Trade Commissioner for the British West Indies (Eastern Group) in Canada, with regard to the possibilities of the British West Indian Islands supplying cassava starch to the Canadian Market. At the present time the annual consumption of cassava starch in Canada approximates 350 tons, obtained principally from Java at a cost of about 2¼ cents per lb. (=$50.00 per ton) *f.o.b.* New York.

The firm responsible for the enquiry is contemplating the manufacture of starch by the erection of a factory in Canada and importing the raw material as gaplek (roots which have been peeled, sliced, and dried). The price offered for gaplek containing ten per cent. moisture and about 50 per cent. starch would be in the neighbourhood of $15.00 per ton delivered in Canada. As the freight charges to Canada would approximate $9.00 per ton it is very improbable that West Indian planters will enter this market.

* * *

Livestock Industry.

At the Trinidad Government Stock Farm Annual Sale held on December 15th the following livestock was purchased through the Advisory Department and subsequently shipped to the various islands: to St. Vincent, a young pure bred Zebu bull, two Large Black Boars, two Large Black Sows and poultry; to Dominica, poultry; to Montserrat, a pure bred Holstein bull and a young Berkshire boar; to St. Kitts, a pure bred Zebu bull and two large Black Sows. Four water buffaloes have also been shipped to St. Kitts from one of the Trinidad Sugar Estates.

Owing to the presence of paralytic rabies amongst animals in Trinidad, Orders-in-Council had been passed by the Governments of Antigua, Montserrat and St. Vincent to prohibit the importation of all animals into these islands from Trinidad. On the recommendation of the Commissioner of Agriculture these embargoes were removed before the date of the Trinidad Government Stock Farm Sale, provided that the animals imported were accompanied by a Certificate of Health signed by a Veterinary

Officer. Paralytic rabies is not a contagious disease, and is apparently only transmitted by the animals being bitten by infected animals. Dogs are very rarely affected and the chief vectors of the disease appear to be infected blood sucking or fruit eating bats. The disease is chiefly confined to certain localities and the importation of animals from the Government Stock Farm where all stock is closely supervised would involve very small risk. Further, the animals likely to be imported from Trinidad are of pedigree or of good blood, and to prohibit them would seriously handicap the improvement of livestock in the other islands.

* * *

Onion Cultivation and Seed Production in Montserrat.

Some useful hints, summarised below, will be found in a bulletin by Mr. C. A. Gomez, of the Department of Agriculture, Montserrat, on onion cultivation and seed production.

According to this bulletin the first essential to successful onion cultivation is reliable seed. Experience has shown that seeds obtained from U.S.A. appear to be unsuitable to local conditions as they will not bulb satisfactorily. Seeds of the Red and White Bermuda varieties grown in the Teneriffe Islands have, however, proved much more reliable while recently, promising Indian types have been grown at the Montserrat Experimental Station. The latter, known as Red Bombay and White Dhulia not only possess better keeping qualities than the Teneriffe but have also developed viable seeds locally.

Onions will grow on a large variety of soils but prefer those which are rich, free working, well drained and of fair depth. The seed should be sown in carefully prepared nursery beds, in shallow narrow drills about six inches apart and covered lightly with not more than half an inch of fine soil. In Montserrat the best time for sowing is late September. About four to six pounds of seed are required per acre. Where ants are troublesome the seed should be mixed, prior to sowing, with a little red lead. Six to eight weeks after sowing, the seedlings can be transplanted on land well forked to a depth of seven to eight inches and which has been banked into flattened beds, four to five feet wide. Pen manure applied at the time of planting will improve the yield and quality of the crop. Seedlings are planted in holes one and a half inches deep at intervals of six inches in three rows, nine inches apart. The earth should be pressed firmly against the roots. The Montserrat system of planting onions as a catch crop on the banks in cotton fields although it does not give the best results, is inexpensive. For larger yields particular attention should be paid to tillage and manuring.

After-cultivation mainly consists of weeding which should be done as frequently as required. During the early stages the mould should be lightly pulled over the forming bulb, taking care that the soil is not allowed to lodge in the crown of the leaves. As soon as the bulbs are well formed there should be no further necessity for moulding as this may retard maturity and sometimes causes rotting of bulbs. Onions are harvested about four months after transplanting and can be left to dry on the top of the soil for a few hours. The tops and roots should be removed and the onions placed in a cool dry house for final curing. This is an operation which is essential for onions which are to be shipped and held in crates for any length of time. It lasts from two to three weeks and onions will lose 25 per cent. of their weight during the drying process. Well cured onions command the best prices.

To obtain the best seed the bulbs of a harvested crop should be used after they have been given a few months' rest. The lower halves of such bulbs, after the third top portions have been cut away, should be planted at eighteen inches apart. Four to five months after transplanting, seed will be produced.

* * *

Miscellaneous News.

Mr. G. A. Jones, Commissioner of Agriculture has been appointed a member of the Trinidad Sugar-Cane Investigation Committee by His Excellency the Governor.

The Commissioner of Agriculture paid an official visit to St. Lucia and Dominica in January, and during February and March visited St. Lucia, St. Kitts-Nevis, Antigua and Montserrat.

Dr. Harland, Cotton Adviser to the Commissioner of Agriculture returned to Trinidad from leave on 7th December. During the period 8th to 23rd March he paid visits to St. Vincent, Carriacou and Grenada.

Mr. P. E. Turner, Adviser in Sugar-cane Experiments to the Commissioner of Agriculture has prepared a preliminary report on his visit to Antigua in November, describing the details of the Sugar-Cane Experiments which are to be carried out according to his recommendations. Mr. Turner again visited Antigua and St. Kitts in February and March.

The Commissioner of Agriculture has received a letter from His Honour the Administrator of Dominica expressing the thanks of the Government for the facilities offered to Mr. H. B. Pidduck during his residence at the College.

A report has been received from Mr. R. E. Kelsick, Agricultural Superintendent in St. Kitts, on his visit to Anguilla in November. Mr. Kelsick states that weather conditions during 1933 were very favourable, the rainfall recorded up to the end of November amounting to over 60 inches. It is estimated that 200 acres of cotton have been planted for the 1933-34 season, and the crop appeared to be in a satisfactory condition.

Mr. H. Manning, a former student of the Imperial College of Tropical Agriculture and holder of the College Diploma has been selected to fill the post of Agricultural Assistant and Science Master at the Grammar School, Montserrat, in succession to Mr. E. S. A. Chin.

LIST OF TRINIDAD BIRDS WITH FIELD NOTES.

BY

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INTRODUCTION.

A COLLECTION of birds, on which this paper is based, was made in Trinidad during the months of July and August 1931 for the Academy of Natural Sciences of Philadelphia, in order to supplement its South American collection, and to aid in the study and comparison of birds of other regions on the continent. The collection, consisting of 734 specimens and 167 species, was taken by Mr. W. Wedgwood Bowen, Mr. George R. Clark, and myself. General field notes were recorded, and in preparing the specimens the stomachs were saved, and also particular attention was paid to the sexual development of the birds, in order to learn something of their breeding periods. Mr. F. W. Urich of the department of entomology of the Imperial College of Tropical Agriculture, very generously offered to study the stomach contents of the insectivorous birds, and Mr. Henry W. Fowler of the Academy of Natural Sciences of Philadelphia has kindly identified the fish contained in the water bird stomachs.

In this paper I have included all the species that have been definitely recorded from Trinidad, whether secured by us or not. The nomenclature and systematic order have been brought up to date as nearly as possible, and in order to be of assistance in the synonymy, I have included, following the scientific name, the number referring to that species in F. M. Chapman's paper on the birds of Trinidad in the *Bull. of the Amer. Mus. of Nat. Hist.*, Vol. VI, 1894, which in turn gives the synonymy to A. Léotaud's work published in Port-of-Spain, Trinidad, 1866, and to E. C. Taylor's paper in the *Ibis*, pp. 73-97, 1864. For the addition of the local names, I am much indebted to Mr. Urich.

The collector's name, mentioned as recording the species not secured by us, refers to the following publications:

TAYLOR—E. C. Taylor, *Ibis*, pp. 73-97, 1864.

CHAPMAN—F. M. Chapman, *Bull. of the Amer. Mus. of Nat. Hist.*, Vol. VI, 1894, pp. 1-86.

CHAPMAN, 1895—F. M. Chapman, *Bull. of the Amer. Mus. of Nat. Hist.*, Vol. VII, 1895, pp. 321-326.

LÉOTAUD—A. Léotaud, *Oiseaux de l' Ile de la Trinidad*, Trinidad, 1866.

ANDRÉ—C. E. Hellmayr, *Nov. Zool., Tring.*, 1906, Vol. XIII, pp. 1-60, (based on E. André's collection from Trinidad).

CHERRIE, 1906—G. K. Cherrie, *Brooklyn Mus. Bull.*, Vol. I, pp. 187-192, 1906.

CHERRIE, 1908—G. K. Cherrie, *Brooklyn Mus. Bull.*, Vol. I, pp. 353-370, 1908.

CARRIKER—M. A. Carriker, Jr., a list of species taken by him in Trinidad for the Carnegie Museum, Pittsburgh, which he kindly gave me.

WILLIAMS—C. B. Williams, *Bull. of the Dept. of Agric. of Trinidad and Tobago*, parts II-IV, Vol. XX, pp. 123-185, 1922.

Mr. Bowen, Mr. Clark, and myself wish to express our appreciation for the generous facilities and assistance given to us by the authorities of the Imperial College of Tropical Agriculture, and in particular we wish to thank Mr. F. W. Urich and Mr. W. A. Tansley for adding much to the pleasantness of our stay. We are also indebted to the Barber Asphalt Company for our visit to Brighton, where we were very well received.

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Mr. C. B. Williams in his paper on Trinidad Birds; *Bull. of the Dept. of Agriculture, Trinidad and Tobago* (parts II-IV, Vol. XX, pp. 123-185, 1922), published a preliminary bibliography, and the following below are additions to this list.

CHERRIE, G. K.—Species of Birds collected at St. Mathews Cocoa Estate, Heights of Aripo, Trinidad; *Brooklyn Mus. Bull.*, I, pp. 187-192, 1906.

CHERRIE, G. K.—On a Second Small Collection of Birds from Trinidad; *Brooklyn Mus. Bull.*, I, pp. 353-370, 1908.

INGRAM, C.—Guacharo Cave; *Avicult. Mag.*, 2, IV, pp. 236-239, 1906.

INGRAM, C.—Stray Notes on the Birds of Trinidad and Tobago, B.W.I.; *Zoologist*, pp. 249-255, 1913.

SMOOKER, G. D.—List of Birds known to breed in a given area in the Island of Trinidad; *Oologists' Rec.*, London, pp. 65-69, 1928.

CARRIKER, M. A., Jr.—The Cave Birds of Trinidad, *Auk.* pp. 186-194, 1931.

Family TINAMIDAE.

Crypturellus soui andrei (Brabourne & Chubb).
Pileated Tinamou, Caille.—(303).
(Léotaud, Chapman, André.)

Family COLYMBIDAE.

Poliocephalus dominicus subsp. ?
Short-billed Grebe, San Domingo Grebe.—(302).
(Léotaud, Williams sight.)

Podilymbus podiceps antillarum Bangs.
Pied-billed Grebe.—(301).
(Léotaud, André.)

Family PELECANIDAE.

Pelecanus occidentalis occidentalis Linnaeus.
Brown Pelican.—(287).
Very common all along the coast. At Soldado Rock more than a thousand were seen resting on the rocks and towards evening flocks of from five to thirty kept coming in. They were not nesting.

Family SULIDAE.

Sula sula sula (Linnaeus).
Red-footed Booby, White Booby.—(291).
(Léotaud, Ridgway *Proc. U.S.N.M.*, VII, 1884, p. 173.)

Sula leucogaster leucogaster (Boddaert).
White-bellied Booby, Brown Booby.—(290).
About a dozen of these birds were seen on or about Soldado Rock August 29. They were not nesting.

Family PHALACROCORACIDAE.

Phalacrocorax olivaceus olivaceus (Humboldt).
Cormorant.—(288).
(Léotaud observed this bird as a visitor in July.)

Family ANHINGIDAE.

Anhinga anhinga (Linnaeus).
American Darter.—(289).
(Léotaud, André.)

Family FREGATIDAE.

Fregata magnificens rothschildi Mathews.
Frigate Bird, Man-o'War Bird.—(286).
Very common all along the coast and occasionally seen flying very high over land. As many as 40 were seen most of the day on a visit to Soldado Rock. They were not breeding.

Family ARDEIDAE.

Ardea herodias subsp. ?
Great Blue Heron.—(266).
(Léotaud.)

Ardea cocoi Linnaeus.
Cocoi Heron.—(267).
(Léotaud.)

Butorides striatus striatus (Linnaeus).
Streaked Heron.—(260).
Very common. The birds were all in breeding condition excepting one which was in the immature plumage. One female had full sized yolk in ovary July 11.

Florida caerulea (Linnaeus).
Little Blue Heron.—(261).
The most common of the herons. They were in breeding condition and also there were a number of birds in the immature plumage.

Casmerodius albus ergretta (Gmelin).
American Egret, White Egret.—(265).
(Léotaud, Chapman, André, Williams sight).

Leucophoyx thula thula (Molina).
Snowy Egret.—(264).
(Léotaud.)

Hydranassa tricolor rufimentum Hellmayr.
Red-necked Heron, Louisiana Heron.—(262).
Fairly common. A male taken July 14 with enlarged testes, and a female August 25 with yolks in ovary.

Agamia agami (Gmelin).
Agami Heron.—(263).
(Léotaud, André.)

Nycticorax nycticorax hoactli (Gmelin).
Black-crowned Night Heron.—(259).
(Léotaud, André, Williams.)

Nyctanassa violacea violacea (Linnaeus).
Yellow-crowned Night Heron.—(258).
(Taylor, Léotaud, André.)

Tigrisoma lineatum lineatum (Boddaert).
Tiger Bittern, Rush Crabier.—(271).
(Léotaud.)

Ixobrychus involucris (Vieillot).
Variegated Bittern.—(268).
One female was flushed out of high rushes in the Caroni Swamp, July 17. Yolks were in ovary. It is of interest to note that Léotaud also found this bird, which is probably the earliest record for northern South America.

Ixobrychus exilis erythromelas (Vieillot).
Chestnut-backed Bittern.—(269).
(Léotaud, André.)

Botaurus pinnatus (Wagler).
Pinnated Bittern.—(270).
Found two males of this bird in Caroni Swamp, August 29, and were attracted to them by their booming. We had been to this locality a number of times previously and had neither heard nor seen them. Their testes were enlarged, and it would seem as if this was the commencement of their breeding season.

Family COCHLEARIIDAE.

Cochlearius cochlearius cochlearius (Linnaeus).
Boat-billed Heron.—(272).
(Léotaud, Chapman 1895, André.)

Family CICONIIDAE.

Mycteria americana Linnaeus.
Wood Ibis.—(273).
(Léotaud.)

Family THRESKIORNITHIDAE.

Gaura rubra (Linnaeus).
Scarlet Ibis.—(274).
(Léotaud, André.)

Ajaia ajaja (Linnaeus).
Roseate Spoonbill.—(275).
(Léotaud, André.)

Family ANHIMIDAE.

Anhima cornuta (Linnaeus).
Horned Screamer.—(276).
(Léotaud.)

Family ANATIDAE.

Dendrocygna viduata (Linnaeus).
White-faced Tree-Duck.—(279).
(Léotaud.)

Dendrocygna bicolor bicolor (Vieillot).
Fulvous Tree-Duck.—(280).
A pair, evidently about to nest, the female having several large yolks in the ovary, were taken in a large marsh of the Caroni Swamp, August 27. Several other birds were seen singly or in pairs.

Dendrocygna autumnalis discolor Sclater and Salvin.
Grey-breasted Tree-Duck, Whistling Duck.—(278).
(Léotaud.)

Cairina moschata (Linnaeus).
Muscovy Duck.—(277).
(Léotaud.)

Anas discors Linnaeus.
Blue-winged Teal.—(284).
(Léotaud, André.)

Mareca americana (Gmelin).
American Wigeon.—(285).
(Léotaud.)

Spatula clypeata (Linnaeus).
Shoveller.—(283).
(Léotaud.)

Nyroca affinis (Eyton).
Lesser Scaup.—(282).
(Léotaud.)

Nomonyx dominicus (Linnaeus).
Masked-Duck, Squat-Duck.—(281).
(Léotaud, André.)

Family CATHARTIDAE.

Sarcoramphus papa (Linnaeus).
King Vulture, King Corbeau.—(183).
(Recorded by Taylor and Léotaud, but apparently not since that time.)

Coragyps atratus foetens (Lichtenstein).
Black Vulture.—(185).
Common everywhere though in recent years it has been driven off the city streets. None were collected.

Cathartes aura ruficollis Spix.
Turkey Vulture, Cedros Corbeau.—(184).
A few of these birds were seen (with the red head). None were collected.

Family ACCIPITRIDAE.

Elanus leucurus leucurus (Vieillot).
White-tailed Kite.
One female taken on Caroni Swamp August 3. It was accompanied by another bird and seen to hover like a kestrel. This appears to be a new record for Trinidad.

Elanoides forficatus yetapa (Vieillot).
Swallow-tailed Kite, Scissor-tailed Kite.—(187).
(Léotaud, André, Williams sight.)

Odontriorchis palliatus (Temminck).
Guiana Hawk.—(198).
(Léotaud, Chapman.)

Chondrohierax uncinatus (Temminck).
Red-collared Kite, Bluish Hawk.—(197).
(Léotaud.)

Harpagus bidentatus bidentatus (Latham).
Double-toothed Hawk.—(195).
(Léotaud, André.)

Ictinia plumbea (Gmelin).
Plumbeous Kite.—(186).
One bird taken in immature plumage near Brighton in the forest. Several others were observed in the vicinity.

Rostrhamus sociabilis sociabilis (Vieillot).
Everglade Kite, Hook-billed Kite.—(188).
(Léotaud.)

Heterospizias meridionalis meridionalis (Latham).
Red-winged Hawk.
One male taken on Piarco Savannah, August 23. It was in company with two other birds and they were seen several weeks previous to this date in the same vicinity. This makes a new record for Trinidad.

Buteo albicaudatus colonus Berlepsch.
White-tailed Buzzard.
(André.)

Buteo albonotatus abbreviatus Cabanis.
Small Black Buzzard.—(190).
(Léotaud.)

Asturina nitida nitida (Latham).
Shining Buzzard Hawk.—(194).
One female taken on Caroni Swamp, July 22.

Leucopternis albicollis albicollis (Latham).
White-collared Hawk, Black-backed Hawk.—(193).
(Taylor, Léotaud, André, Carriker.)

Hypomorphnus urubitinga urubitinga (Gmelin).
Brazilian Eagle, Eagle-Hawk.—(191).
(Léotaud.)

Buteogallus anthracinus cancrivorus (Clark).
Mexican Black Hawk.—(192).
(Léotaud.)

Spizaetus ornatus (Daudin).
Crested Hawk-Eagle.—(199).
(Léotaud.)

Spizaetus tyrannus (Weid).
Tyrant Hawk-Eagle.—(200).
(Léotaud.)

Circus buffoni (Gmelin).
Long-winged Harrier.—(189).
Obtained one bird on the Caroni Swamp. In sexing this bird, it was found to have two ovaries, though the left one was half again as large.

Pandion haliaetus carolinensis (Gmelin).
American Osprey, Fish-Hawk.—(207).
(Taylor, Léotaud.)

Family FALCONIDAE.

Gampsonyx swainsonii leonae Chubb.
Brown Hawk.—(196).
(Léotaud.)

Falco peregrinus anatum Bonaparte.
Duck-Hawk.—(201).
(Taylor, Léotaud, André.)

Falco deiroleucus Temminck.
Orange-breasted Falcon, White-throated Falcon.—(203).
(Léotaud.)

Falco fuscocaerulescens fuscocaerulescens Vieillot.
Black-bellied Falcon.—(202).
(Léotaud, Chapman sight.)

Falco columbarius columbarius Linneaus.
Pigeon Hawk.—(205).
(Léotaud.)

Family CRACIDAE.

Pipile pipile (Jacquin).
White-headed Guan.—(216).
(Taylor, Léotaud, Chapman, André.)

Family ARAMIDAE.

Aramus scolopaceus scolopaceus (Gmelin).
Southern Limpkin.—(257).
(Léotaud, Chapman sight.)

Family RALLIDAE.

Rallus longirostris longirostris (Boddaert).
Clapper Rail, Long-billed Rail.—(254).
(Léotaud, André.)

Pardirallus maculatus maculatus (Boddaert).
Spotted Rail.—(252).
(Léotaud, André.)

Aramides axillaris Lawrence.
Venezuelan Wood Rail, Red Waterfowl.—(255).
(Léotaud, Chapman, André.)

Aramides cajanea cajanea (Müller).
Cayenne Wood Rail, Great Waterfowl.—(256).
(Léotaud, André.)

Porzana carolina (Linnaeus).
Carolina Rail, Sora.—(250).
(Léotaud.)

Porzana albicollis (Vieillot).
White-necked Crake.—(251).
(Taylor, Léotaud.)

Creciscus exilis exilis (Temminck).
Temminck's Crake, Little Crake.—(252).
(Léotaud.)

Gallinula chloropus galeata (Litchtenstein).
Red-seal Coot.—(248).
(Léotaud, André, Williams sight.)

Ionornis martinica (Linnaeus).
Purple Gallinule, Blue-seal Coot.—(249).
A nesting pair were taken in a reed swamp on the Oropuche River with two fresh eggs August 19. Others were seen on the Caroni Swamp.

Fulica americana americana Gmelin.
American Coot.—(247).
(Léotaud.)

Family HELIORNITHIDAE.

Heliornis fulica (Boddaert).
Coot-like Heliornis, American Finfoot.—(246).
(Léotaud.)

Family JACANIDAE.

Jacana jacana intermedia (Sclater).
Common Jacana, Spur-wing.—(217).
Very common in the marsh and rice fields. They were breeding, one female having a soft shelled egg in the oviduct.

Family HAEMATOPODIDAE.

Haematopus palliatus Subsp. ?
Oyster-catcher.—(218).
(Léotaud.)

Family CHARADRIIDAE.

Charadrius semipalmatus Bonaparte.
Semipalmated Plover, Ring-necked Plover.—(221).
Three females were obtained. The earliest was August 13.

Charadrius collaris Vieillot.
Collared Plover.
Four birds were taken on the Caroni Swamp. Their sex organs were small. I have found no previous records from Trinidad.

Pagolla wilsonia cinnamomina Ridgway.
Wilson's Plover.—(220).
(Léotaud, André.)

Pluvialis dominica dominica (Müller).
American Golden Plover.—(222).
(Léotaud.)

Squatarola squatarola (Linnaeus).
Grey Plover, Black-bellied Plover.—(223).
(Léotaud.)

Arenaria interpes morinella (Linnaeus).
Turnstone.—(219).
A flock of about eighteen birds was seen feeding upon the rocks near the surf on Soldado Rock August 29.

Family SCOLOPACIDAE.

Capella delicata (Ord).
Wilson's Snipe.—(244).
(Léotaud, Williams sight.)

Phaeopus hudsonicus (Latham).
Hudsonian Curlew.—(225).
(Léotaud, Williams.)

Phaeopus borealis (Forster).
Eskimo Curlew.—(224).
(Léotaud.)

Bartramia longicauda (Bechstein).
Upland Plover.—(228).
(Léotaud, André.)

Actitis macularia (Linnaeus).
Spotted Sandpiper.—(226).
Very common. We found this bird on Caroni Swamp and along the beaches. They were taken as early as August 3.

Tringa solitaria solitaria Wilson.
Eastern Solitary Sandpiper.—(230).
(Léotaud.)

Catoptrophorus semipalmatus semipalmatus (Gmelin).
Eastern Willet.—(229).
(Léotaud, André.)

Totanus melanoleucus (Gmelin).
Greater Yellowlegs.—(232).
Not uncommon on Caroni Swamp. Two birds were obtained August 27.

Totanus flavipes (Gmelin).
Lesser Yellowlegs.—(231).
Common on Caroni Swamp. We obtained this bird as early as August 13.

Calidris canutus rufus (Wilson).
American Knot.—(241).
(Léotaud.)

Pisobia melanotus (Vieillot).
Pectoral Sandpiper.—(240).
(Léotaud, Williams.)

Pisobia fuscicollis (Vieillot).
White-rumped Sandpiper.—(239).
(Léotaud.)

Pisobia minutilla (Vieillot).
Least Sandpiper.—(238).
(Léotaud, Chapman, André.)

Limnodromus griseus griseus (Gmelin).
Eastern Dowitcher.—(243).
(Léotaud.)

Micropalama himantopus (Bonaparte).
Stilt Sandpiper.—(242).
(Léotaud.)

Ereunetes pusillus (Linnaeus).
Semipalmated Sandpiper.—(237).
Common. First bird was taken August 19.

Ereunetes mauri Cabanis.
Western Sandpiper.—(236).
(Léotaud, André.)

Tryngites subruficollis (Vieillot).
Buff-breasted Sandpiper.—(227).
(Léotaud, Williams.)

Limosa fedoa (Linnaeus).
Marbled Godwit.—(234).
(Léotaud.)

Limosa haemastica (Linnaeus).
Hudsonian Godwit.—(233).
(Léotaud.)

Crocethia alba (Pallas).
Sanderling.—(235).
(Léotaud.)

Family RECURVIROSTRIDAE.

Himantopus mexicanus (Müller).
Black-necked Stilt.—(245).
(Léotaud.)

Family LARIDAE.

Larus atricilla Linnaeus.
Laughing Gull.—(300).
Common. Found along coast and at Soldado Rock.

Phaetusa simplex simplex (Gmelin).
Great-billed Tern.—(298).
Common. Found on the Caroni Swamp and the Oropuche River. Curiously enough we obtained a number of the birds and they were all females. They were not in breeding condition.

Gelochelidon nilotica aranea (Wilson).
Gull-billed Tern, Marsh Tern.—(299).
Obtained one female on Caroni Swamp, August 27. Ovaries slightly enlarged.

Sterna hirundo hirundo Linnaeus.
Common Tern.
(André.)
Four birds banded in New Jersey, U.S.A., by J. A. Gillespie, Secretary of the Eastern Bird Banding Association were recovered in Trinidad, one record of which is published in *Bull. of the Northeastern Bird Banding Association* October 16, 1926 and was recovered by R. Goodridge at Erin Bay, Trinidad May 16, 1926.

Sterna dougalli dougalli Montagu.
Roseate Tern.—(295).
One bird was secured from a mixed flock along coast near mouth of Oropuche River, August 19.

Sterna fuscata fuscata Linnaeus.
Sooty Tern.
Four or five of these birds were found at Soldado Rock, August 29. Two males had testes slightly enlarged.

Sterna antillarum antillarum (Lesson).
Least Tern.—(294).
Three lone males were taken along canal on edge of Caroni Swamp, September 2. One had testes slightly enlarged.

Thalasseus maximus maximus (Boddaert).
Royal Tern.—(297).
One adult and one immature obtained from a mixed flock along coast near the Oropuche River, August 19.

Thalasseus sandvicensis acuflavidus (Cabot).
Cabot's Tern.
Secured two females from mixed flock as above. This bird appears to be of uncommon occurrence in the West Indies and not to have been recorded from Trinidad previously.

Thalasseus eurygnatha Saunders.
Red-billed Tern, Black-legged Tern, Cayenne Tern.—(296).
(Léotaud.)

Anous stolidus stolidus (Linnaeus).
Noddy.—(293).
Obtained three adults and one immature on Soldado Rock, August 29.

Family RYNCHOPIDAE.

Rynchops nigra nigra Linnaeus.
Black Skimmer.—(292).
(Léotaud, André.)

Family COLUMBIDAE.

Columba speciosa Gmelin.
Splendid Pigeon, Speckled Cushat.—(208).
Apparently common, though we were only able to obtain one male with testes enlarged. They are greatly sought after for food and hence very wary.

Columba rufina subsp. ?
Blue Cushat.—(209).
One immature male was taken on Caroni Swamp, Cory described a new form from Tobago, *Field Mus. of Nat. Hist. Ornith.* Series Vol. 1, No. VIII, p. 295, 1915, with no mention of Trinidad. Previous to this Hellmayr with his André collection remarked that he could not separate the Tobago birds from those of Trinidad.

Zenaida auriculata rubripes Lawrence.
Wine-coloured Dove.
Obtained one male on Caroni Swamp with testes enlarged. This appears to be a new record for Trinidad.

Columbigallina passerina albivitta (Bonaparte).
Speckled Ground Dove.
One female and two males were taken on Piarco Savannah. They were evidently breeding, as the female had a yolk in the ovary and the males had enlarged testes. This bird is of interest, there being no definite records from Trinidad. It agrees most nearly with the Venezuela and Colombian race, as against the Grenada or the British Guiana race.

Columbigallina minuta minuta (Linnaeus).
Grey Ground Dove.
Locally common. We found this bird on Piarco Savannah and at Brighton.

Columbigallina rufipennis rufipennis (Bonaparte).
Rufous-winged Ground Dove.—(213).
Abundant, especially in open and scrub country. Most of the birds were in decided breeding condition.

Claravis pretiosa (Ferrari-Perez).
Cinereous Dove, Blue Partridge Dove.—(212).
One bird secured only on the Oropuche River, with testes enlarged.

Leptotila verreauxi verreauxi Bonaparte.
Rusty Dove.—(211).
One immature assuming adult plumage, and a female with a full size yolk in ovary, were taken.

Leptotila rufaxilla rufaxilla (Richard & Bernard).
Grey-fronted Dove.—(210).
Common. A nest (and bird) was taken August 12 in forest containing two eggs hard set.

Oreopeleia montana (Linnaeus).
Red Dove, Partridge Dove.—(215).
Obtained one female at the head of Caura Valley.

Oreopeleia linearis venezuelensis (Salvadori).
Mountain Dove.—(214).
(Léotaud, Cherrie 1906 and 1908, Carriker.)

Family CUCULIDAE.

Coccyzus americanus americanus (Linnaeus).
Yellow-billed Cuckoo.—(171).
(Léotaud, Chapman obtained one on Monos.)

Coccyzus minor minor (Gmelin).
Mangrove Cuckoo.—(169).
One male with testes enlarged was obtained on the Oropuche River in the mangroves.

Coccyzus melacoryphus Vieillot.
Dark-headed Cuckoo.—(168).
(Léotaud.)

Coccyzus erythrophthalmus Wilson.
Black-billed Cuckoo.—(170).
(Léotaud obtained one bird in September.)

Piaya minuta minuta (Vieillot).
Little Cuckoo, Lesser Piaya.—(167).
Were only able to obtain three specimens, two females of which had ovaries slightly enlarged.

Piaya cayana insulana (Hellmayr).
Squirrel Cuckoo.—(166).
Fairly common. Their sex organs were enlarged.

Tapera naevia naevia (Linnaeus).
Brown Cuckoo, Wife-sick Trinity.—(165).
Common. Found in brush country, especially about the Caroni Swamp. The birds were in breeding condition and one female had a soft shelled egg in the oviduct.

Crotophaga major Gmelin.
Marsh Tick Bird.—(164).
Not uncommon in swampy areas. The sex organs were enlarged and one female had yolks in ovary, August 20.

Crotophaga ani Linnaeus.
Common Ani, Tick Bird.—(163).
Abundant everywhere. One fledgling was secured from a party of four or five out of a low thick palm July 20, and a nest containing seven eggs was taken, September 3, from Caroni Swamp.

Family PSITTACIDAE.

Orthopsittaca manilata (Boddaert).
Aeta Parrot, Little Macaw.—(173).
(Léotaud describes this bird without remark.)

Forpus passerinus viridissimus (Lafresnaye).
Blue-winged Parrakeet.
Very common locally. We found this bird abundant in the mangroves of Caroni Swamp and also in great numbers roosting in the bushes about the Staff House at Brighton. Their sex organs were enlarged. Williams appears to be the first to record this bird's appearance in Trinidad in 1916.

Amazona amazonica amazonica (Linnaeus).
Orange-winged Amazon, Green Parrot.—(174).
Abundant. Often seen in large flocks passing overhead in the evening. Sex organs were slightly enlarged.

Pionus menstruus (Linnaeus).
Red-vented Parrot, Blue-headed Parrot.—(175).
(Léotaud, Chapman.)

Urochroma hueti (Temminck).
Red-winged Parrakeet.—(177).
(Léotaud records it as a rare visitor.)

Urochroma batavica (Boddaert).
Seven-coloured Parrakeet.—(176).
Common. Often seen in flocks from twenty to thirty wheeling about partially cleared country. Their sex organs were small.

Family TYTONIDAE.

Tyto alba tuidara (Gray).
Barn Owl.—(178).
Two were taken on the Caroni Swamp. Both had testes slightly enlarged. One of the birds was flushed in the early afternoon from a bush in an

old cane field overgrown with scrub. These birds are of the light phase with very fine spotting below. One of them had almost no buff ground colour on the underside. The wings measure 315 mm., 318 mm. Hartert does not mention Trinidad in his review of the Barn Owls, *Nov. Zool.*, 1929, p. 101. He gives Ecuador, Colombia, and Venezuela as the range for *T. a. contempta*. I saw two birds in the U.S. National Museum from Western Venezuela, which fitted in well with this race. However, they are the opposite extreme from the two Trinidad ones. The Trinidad birds can be very closely matched in plumage with the North American form, but I found in the *Cat. of the Birds of the Brit. Mus.*, Vol. II, p. 295, that Sharpe notes the South American form as averaging smaller than the North American one. Upon measuring a series of North American birds, I observed that they were all considerably larger in the wing measurement with but very few exceptions than the two Trinidad birds. I therefore believe they belong most closely to the Brazilian and Argentine race mentioned by Hartert.

Family STRIGIDAE.

Otus choliba crucigerus (Spix).
Spix's Scops Owl, Screech Owl.—(180).
(Léotaud, Chapman, André, Cherrie 1908.)

Pulsatrix perspicillata perspicillata (Latham).
Spectacled Owl, Collared Owl.—(181).
(Léotaud, André, Cherrie 1908, Williams.)

Ciccaba virgata virgata (Cassin).
Variable Wood Owl, Tawny Owl.—(179).
(Léotaud, André.)

Glaucidium brasilianum phalaenoides (Daudin).
Trinidad Pygmy Owl.
Two birds were taken at St. Augustine, where several were often heard calling at the same time. Both were males of the reddish phase and had testes slightly enlarged.

Family STEATORNITHIDAE.

Steatornis caripensis Humbold.
Oil Bird, Guacharo, Diablotin.—(147).
A small cave up the Arima Valley was visited August 6. According to local reports, as we found it to be—the nesting was over. All the specimens were completing their moult, and the sex organs were only slightly enlarged. Cherrie states in his paper of the *Brooklyn Mus. Sci. Bull.*, Mar., 1908, p. 368, that the Guacharo has two nesting seasons each year; March and April, and August and September. Carriker told me that he visited the Shagramal Caves July 7 to 12, and the Oropuche Caves July 18 to 23, at which times he found a few young, but, when he visited the Shagramal Caves August 27 to September 6, he found no evidence of breeding. Léotaud states that the laying season is about May, and Williams records finding eggs and young April 23. This seems to indicate that the nesting period extends from April to July inclusive.

Family NYCTIBIIDAE.

Nyctibius griseus griseus (Gmelin).
Giant Goatsucker, Potoo, Poor-me-one.—(143).
(Taylor, Léotaud, Chapman, André, *See Ibis* 1925, Plates 16-21.)

Family CAPRIMULGIDAE.

Chordeiles acutipennis acutipennis (Boddaert).
South American Nighthawk.—(142).
Small flocks of these birds were seen on the Oropuche River and Caroni Swamp in the latter part of August. They were in moult, and sex organs were small.

Podager nacunda minor Cory.
Nacunda Nighthawk.—(145).
Counted as many as thirty birds flying over at one time on the Caroni Swamp in the evening, and also seen at Brighton. The birds were in moult though their sex organs were slightly enlarged.

Lurocalis semitorquatus semitorquatus (Gmelin).
Semi-collared Nighthawk.—(144).
(Taylor, Léotaud, Chapman 1895, André.)

Nyctidromus albicollis albicollis (Gmelin).
White-necked Nighthawk, Who-are-you.—(146).
These birds were found fairly common along roads while motoring at night. They were moulting birds.

Thermochalcis cayennensis cayennensis (Gmelin).
Cayenne Nighthawk.
One male taken July 17 along road bordering the Caroni Swamp. Mr. Zimmer of the American Museum of New York kindly identified this bird. This is apparently the first record for Trinidad of this species, which is the mainland race and not the one from Tobago.

Family MICROPODIDAE.

Chaetura spinicauda (Temminck).
Spine-tailed Swift.—(138).
(Chapman.)

Chaetura chapmani chapmani Hellmayr.
Chapman's Swift.
(Chapman 1895, See *Bull. of Brit. Ornith. Club*, 1907, p. 62.)

Chaetura cinereiventris lawrencei (Ridgway).
Lawrence's Swift.—(137).
Two females were secured from a large flock among which were a large number of *Streptoprocne zonaris albicincta* at Matura.

Chaetura brachyura brachyura (Jardine).
Short-tailed Swift.—(139).
A pair was secured from a flock of about fifty, which was accompanied by a small number of *Panyptila cayanensis*.

Cypseloides rutilus (Vieillot).
Shining Swift.—(141).
(Léotaud.)

Streptoprocne zonaris albicincta (Cabanis).
Banded Swift, Ringed Gowrie.—(140).
Several of these birds were obtained from a large flock of about a hundred on August 28. With these were a large number of *Chaetura cinereiventris lawrencei*. All of the specimens were just completing their moult.

Panyptila cayanensis (Gmelin).
Andean Swift.—(136).
Two females were secured from a flock of about fifty birds, which largely consisted of *Chaetura b. brachyura* of which two were taken. They were hawking over partial clearings and woodland.

Family TROCHILIDAE.

Glaucis hirsuta hirsuta (Gmelin).
Hairy Hermit, Brownbreast.—(120).
Common in lower growth of forest. One female of August 19 had yolk in ovary.

Phaethornis guyi guyi (Lesson).
Guy's Hermit.—(122).
Obtained one male at the head of Caura Valley July 30. Testes were slightly enlarged.

Pygmornis longuemarea (Lesson).
Longuemare's Hermit.—(121).
(Taylor, Léotaud, Chapman, André, Cherrie 1908, Williams.)

Florisuga mellivora mellivora (Linnaeus).
Great Jacobin.—(125).
(Taylor, Léotaud, André, Carriker, Williams.)

Colibri delphinae (Lesson).
Brown Violet-ear, Blue-eared Hummer.—(129).
(Léotaud, André, Cherrie 1906.)

Lampornis viridigula (Boddaert).
Green-throated Mango.—(124).
(Taylor, Léotaud, André.)

Lampornis nigricollis (Vieillot).
Violet-tailed Mango, Plastron.—(123).
Common. Though we met with this bird frequently no adult males were observed. One male in the immature plumage was taken July 31.

Chrysolampis mosquitus (Linnaeus).
Ruby-and-Topaz Humming Bird.—(128).
Two fully adult males were secured July 20 and 21, and one female.

Lophornis ornata (Boddaert).
Tufted Coquette.—(126).
(Taylor, Léotaud, André, Carriker, Williams.)

Chlorostilbon caribaea lessoni (Simon & Dalm).
Lawrence's Emerald, Carib Emerald.—(135).
(Taylor, André, Cherrie 1908, Carriker.)

Chlorestes notatus (Reichenow).
Blue-chinned Sapphire.—(134).
(Taylor, Léotaud, Chapman, André, Cherrie 1908, Carriker.)

Polytmus thaumantias thaumantias (Linnaeus).
Golden-throated Humming Bird, Pearl.—(132).
Found in open marshes of Caroni Swamp. They were observed on one occasion about dusk to hover, seemingly motionless, several feet above the tall reeds. Upon approach, they darted off to resume a similar position. Two or three were seen performing in the same vicinity. Whether they were doing this for sexual display or merely waiting for insects, it was not ascertained. Both males obtained had testes enlarged.

Agyrtria chionopectus chionopectus (Gould).
White-breasted Emerald.—(131).
Common. Obtained a male August 18 with testes enlarged.

Saucerottea tobaci erythronota (Lesson).
Trinidad Erythronote, Emerald.—(133).
Common. Found near Brighton, and at Las Lomas.

Anthoscenus longirostris longirostris (Vieillot).
Long-billed Star-throat, Carmine.—(130).
(Taylor, Léotaud, André.)

Calliphlox amethystina (Boddaert).
Amethyst.—(127).
(Léotaud, Williams sight.)

Family TROGONIDAE.

Trogonurus collaris collaris (Vieillot).
Collared Trogon.—(159).
Two males were taken on Mt. Tabor, June 27. Both were in breeding condition.

Trogon strigilatus strigilatus Linnaeus.
Green Trogon, Large Yellow-bellied Trogon.—(160).
Common. In breeding condition.

Trogon violaceus violaceus (Gmelin).
Southern Trogon, Little Yellow-bellied Trogon.—(161).
Common. In breeding condition.

Family ALCEDINIDAE.

Megaceryle alcyon alcyon (Linnaeus).
Belted Kingfisher.—(156).
(Léotaud seems to have made the only definite record of this bird, and to quote from him, "*Ce martinpêcheur est loin d'être rare ici.*")

Megaceryle torquata torquata (Linnaeus).
Great Grey Kingfisher.—(158).
(Léotaud.)

Chloroceryle amazona (Latham).
Great Green Kingfisher, Amazon Kingfisher.—(157).
(Léotaud records one female.)

Chloroceryle americana insularum* Laubman.
Little Green Kingfisher, Red-billed Kingfisher.(154).
One bird found at the mouth of the Oropuche River.

Chloroceryle aenea aenea (Pallas).
Pygmy Kingfisher, Little Kingfisher.—(155).
(Taylor, Léotaud, André.)

Family MOMOTIDAE.

Momotus bahamensis Swainson.
King of the Woods.—(153).
Two specimens only were obtained up the Caura Valley.

Family GALBULIDAE.

Galbula ruficauda ruficauda Cuvier.
Jacamar.—(162).
Common. Sex organs slightly enlarged.

Family RAMPHASTIDAE.

Ramphastos vitellinus Lichtenstein.
Sulphur-and-white-breasted Toucan.—(172).
A fairly common bird of the forest. They appeared to be more common in the southern part of the island where it is not so thickly settled. Their sex organs were slightly enlarged.

* Cf. Laubman, A., *Anz. Orn. Ges. Bayern*, 4, pp. 25-32, 1922.

Family PICIDAE.

Piculus* rubiginosus trinitatis Ridgway.
Trinidad Green Woodpecker, Blue-headed Woodpecker.—(148).
Common. The birds were moulting and their sex organs were small.

Celeus elegans leotaudi Hellmayr.
Yellow-headed Woodpecker.—(150).
Three specimens were seen and obtained only.

Ceophloeus lineatus lineatus (Linnaeus).
Black-throated Woodpecker.—(152).
Not uncommon. Their sex organs were small.

Phloeoceastes melanoleucos melanoleucos (Gmelin).
Black-and-White Woodpecker, Big Red-headed Woodpecker.—(151).
(Léotaud, Chapman.)

Veniliornis kirkii kirkii (Malherbe).
Little Red-headed Woodpecker.—(149).
Not uncommon. Their sex organs were small.

Family DENDROCOLAPTIDAE.

Dendroplex picus altirostris (Léotaud).
Picine Wood-Hewer.—(106, 108).
(Léotaud, *See* Bangs and Pennard, *Bul. Mus. Comp. Zool.* 64, p. 367, 1921. *Dendrocolaptes picus* and *D. altirostris* distinguished by Léotaud are synonyms.)

Xiphorhynchus susurrans susurrans (Jardine).
Cocoa Wood-Hewer, Cocoa Insect-Pecker.—(107).
A common bird of the forest. All the specimens were in breeding condition.

Lepidocolaptes souleyetii littoralis (Hartert & Goodson).
Coast Wood-Hewer.—(109).
(Léotaud, Chapman, André.)

Dendrocincla meruloides meruloides (Lafresnaye).
Northern Red-vented Wood-Hewer, Little Cacao Insect-Pecker.—(105).
A common bird of woodland and forest. The birds were in breeding condition and one immature taken July 30.

Family FURNARIIDAE.

Synallaxis albescens nesiotis Clark.
White-throated Spine-Tail, Vickey.—(102).
(Léotaud, Chapman, André, Cherrie 1906-08, Carriker.)

Synallaxis cinnamomea carri Chapman.
Trinidad Spine-Tail.—(103).
(Léotaud, Chapman 1895, André, Carriker.)

Certhiaxis cinnamomea cinnamomea (Gmelin).
Yellow-throated Spine-Tail.—(101).
Very common in marsh and swampy country. A nest of three eggs, which were fresh, was taken August 27.

Xenops rutilus heterurus Cabanis & Heine.
Red-tailed Recurved-Bill.—(104).
One specimen was secured near Brighton.

Sclerurus albigularis albigularis Sclater & Salvin.
White-throated Leaf-Scraper.—(100).
Obtained one female on Mt. Tabor with ovaries slightly enlarged.

* Cf. Oberholser, *Proc. Biol. Soc. Wash.* XXXVI, 1923, p. 201.

Family FORMICARIIDAE.

Taraba major semifasciatus (Cabanis).
Para Bush-Shrike, Cuckoo.—(110).
Three birds only were secured.

Sakesphorus canadensis trinitatis (Ridgway).
Black-crested Bush-Shrike.—(112).
Found common along beach below Brighton and in mangrove swamp on the Oropuche River. Most of the specimens had their sex organs slightly enlarged.

Thamnophilus doliatus fraterculus Berlepsch & Hartert.
White-barred Bush-Shrike, Bush Guinea Bird.—(111).
Common everywhere. Most of the specimens were in breeding condition.

Dysithamnus mentalis andrei Hellmayr.
André's Bush-Bird.—(113).
An immature male and one female with ovaries slightly enlarged.

Myrmotherula axillaris axillaris (Vieillot).
White-flanked Ant-Bird.—(114).
Not common. Found in undergrowth of forests. Two males with testes enlarged and one female with ovaries small.

Neorhopias grisea intermedia (Cabanis).
Allied Ant-Wren.—(115).
(This bird is recorded by Taylor on the island of Chacachacare, off Trinidad.)

Ramphocaenus melanurus trinitatis Lesson.
Trinidad Ant-Wren.—(117).
Two specimens were secured only, though a not uncommon bird of the thick growth in forest clearings.

Sclateria naevia naevia (Gmelin).
Surinam Ant-Creeper, Water-Wren.—(118).
(Lesson, *Rev. Zool.*, 1839, p. 42, Léotaud, Chapman, André.)

Myrmeciza longipes longipes (Swainson).
Small Ant-Wren.—(116).
Three males were taken with testes slightly enlarged.

Formicarius analis saturatus Ridgway.
Rufous-necked Ant-Thrush, Cock-of-the-Woods.—(119).
Common terrestrial bird of the forest. Two males had testes enlarged, and one male apparently immature.

Grallaria guatimalensis aripoensis Hellmayr & Seilern.
Trinidad Ant-Thrush.
(*Zool. Mus.*, Munich, Collected by Mr. Klages Aug. and Sept., 1912.)

Family COTINGIDAE.

Attila spadiceus spadiceus (Gmelin).
Cayenne Attila.
(One specimen is recorded by Cherrie 1906.)

Pachyrhamphus polychopterus tristis (Kaup).
Black Thick-bill, Black Hard-beak.—(88).
Two specimens were obtained. Both were females, one of which had ovaries slightly enlarged.

Pachyrhamphus alborgriseus albogriseus Sclater.
Black and White Thick-bill.—(97).
(Taylor.)

Tityra cayana cayana (Linnaeus).
Cayenne Tityra, Blackcap.—(96).
Not common. Found mostly in open woodland. All birds were in breeding condition.

Procnias averano carnobarba (Cuvier).
Black-winged Bell-Bird.—(99).
Only locally common. One female was obtained with sex organs slightly enlarged, two males with testes enlarged and moulting into adult plumage, and one male in immature plumage.

We met with a number of these Bell Birds on a ridge up the Caura Valley. Several of them flew successively into a tall rather thinly-leaved tree above me. After emitting several of their startlingly loud and sharp calls, they flew on. It was most exasperating, as they appeared to vanish the moment they alighted. It must have been that they either perched parallel to the limbs or behind a crotch, as there were no large branches in the tree. An excellent description of the bird's call may be found in the *Auk* 1895, pp. 204-207, by Brewster and Chapman, which observations were made in almost the same piece of forest.

Family PIPRIDAE.

Pipra erythrocephala erythrocephala (Linnaeus).
Golden-headed Manakin.—(94).
Common. Taken in forest country. Some of the specimens had enlarged sex organs while others were in moult.

Manacus manacus trinitatis (Hartert).
White-breasted Manakin, Washer-Woman.—(95).
Common. Found in lower growth of forests. All of the specimens were in breeding condition excepting a young male changing to adult plumage.

Family TYRANNIDAE.

Fluvicola pica pica (Boddaert).
White-shouldered Water-Tyrant, Widow.—(67).
Found very common along the rivers and canals. Two nests were found August 20, containing nestlings. A bird was seen August 26 building.

Arundinicola leucocephala (Linnaeus).
White-headed Marsh-Tyrant, White-headed Widow.—(68).
Common in marshy areas, especially in wet rice fields. A nest was taken August 25 containing three eggs.

Muscivora tyrannus (Linnaeus).
Swallow-tailed Flycatcher.—(93).
These birds were abundant. Great numbers were seen flying overhead in the evening to roost in the mangroves of the Caroni Swamp. They were all in moult, and were gaining their full length tail feathers in the latter part of August.

Tyrannus melancholicus despotes (Lichtenstein).
Grey-headed Kingbird.—(91).
A very common bird though not seen around habitations as much as *Pitangus sulphuratus trinitatis*. Two fledglings were taken July 8 and August 17 and the adults were still breeding.

Tryannus dominicensis vorax Vieillot.
White-breasted Kingbird.—(92).
(Léotaud, André.)

Empidonomus varius septentrionalis Todd.
Guiana Streaked Flycatcher.
Four specimens in fresh plumage were taken in forest country near Brighton about the middle of August. These birds have not been previously recorded in Trinidad.

Legatus leucophaius leucophaius (Vieillot).
Little White-necked Flycatcher, Black-banded Petchary.—(76).
A not uncommon bird of the open woodland found chiefly in the tree-tops. Two immature birds were taken July 24 and the sex organs of the adults were slightly enlarged.

Myiodynastes maculatus maculatus (Müller).
Streaked Flycatcher.—(82).
A not uncommon bird of the heavy forest. Most of the specimens were in breeding condition.

Megarynchus pitangua pitangua (Linnaeus).
Broad-billed Kiskadee.—(83).
Common, usually found in light woodland. The birds were in breeding condition.

Tyrannopsis sulphurea (Spix).
Sulphury Flycatcher.—(78).
(Chapman.)

Pitangus sulphuratus trinitatis Hellmayr.
Kiskadee.—(81).
One of the most noticeable birds of the island. A fledgling was taken July 24, and the adults were in breeding condition.

Myiarchus tyrannulus tyrannulus (Muller).
Rusty-tailed Flycatcher.—(90).
(Taylor, Léotaud, Chapman, André, Cherrie 1908, Carriker, Williams.)

Myiarchus ferox subsp. ?
Fierce Flycatcher.
One male taken on the Oropuche River in the mangroves August 19. This appears to be the first record of this species in Trinidad. Inasmuch as there are a number of possible subspecies which are closely related in this region, I hesitate to place it in any of them or separate it, having but one specimen to deal with. The bird appears to be in very fresh plumage. In general it is very dark above with a decided olive tinge. The centres of the feathers on the crown are dark. The edge of the lesser wing coverts, the upper tail coverts, and the outer edge of the secondaries and the rectrices towards their base rufous with the exception of the outermost rectrix which has the outer web of a decided yellow tinge. The bill is small. Bill (from anterior edge of nostril) 13 mm.; Wing 90 mm.; Tail 85 mm.; Tarsus 19 mm.

Myiarchus tuberculifer tuberculifer (Lafresnaye & D'Orbigny). *Foolish Petchary.*—(89).
Four birds were taken on Mt. Tabor, all of which had their sex organs slightly enlarged and were in moult.

Myiochanes cinereus bogotensis (Bonaparte).
Caribbean Wood-Pewee.—(88).
One immature bird taken on Mt. Tabor on July 16, and another in mora forest in the south August 11.

Empidonax lawrencei Allen.
Lawrence's Pewee, Greenish-bellied Petchary.—(87).
Two specimens were secured from the forest country, one of which was a breeding male.

Cnemotriccus fuscatus cabanisi (Léotaud).
Léotaud's Dusky Flycatcher.—(85) and (86).
(Léotaud, Chapman, Cherrie 1908.)

Myiophobus fasciatus fasciatus (Müller).
Little Brown Flycatcher, Yellow-crested Petchary.—(84).
A pair only were secured from the edge of the Caroni Swamp in bush country. They were apparently a breeding pair.

Platyrinchus mystaceus insularis Allen.
Tobago Flat-Bill, Broad-Bill.—(69).
(Léotaud, Chapman, André, Cherrie 1906 and 1908, Carriker.)

Tolmomyias sulphurescens exortivus (Bangs).
Sulphury Flat-bill, Broad-bill.—(80).
Four birds were taken in forest, three of which were in breeding condition.

Tolmomyias flaviventris aurulentus (Todd).
Yellow-vented Flat-bill, Broad-bill.—(79).
A common bird of the forest and open woodland—inhabiting the lower growth. Most of the birds were in very evident breeding condition.

Perissotriccus ecaudatus (Lafresnaye & D'Orbigny).
Short-tailed Pygmy Tyrant.
(André, Carriker.)

Pseudocolopteryx sclateri (Oustalet).
Sclater's Sharp-winged Tyrant.
Two of these birds, both males in breeding condition, were taken in the Caroni Swamp. They were perched on the tall rushes of the open marsh and the bright yellow underside made a brilliant contrast against the rich green background.

Elaenia flavogaster flavogaster (Thunberg).
Yellow-vented Crested Flycatcher, White-tufted Petchary.—(75).
A common bird of the open country and savannahs.

Elaenia chiriquensis albivertex Pelzeln.
Lawrence's Flycatcher.
One immature taken on Piarco Savannah, August 23.

Elaenia gaimardii trinitatis Hartert & Goodson.
Berlepsch's Crested Flycatcher.—(74).
One female taken August 24 with ovaries enlarged.

Sublegatus modestus glaber Sclater & Salvin.
Salvin's Flycatcher.—(77).
One female and an immature were taken on the Oropuche River in the mangroves, August 20.

Phaeomyias murina incomta (Cabanis & Heine).
Northern Mouse-coloured Flycatcher.—(72).
(Taylor, Chapman found it on Monos Island only.)

Camptostoma obsoletum napaeum Ridgway.
Little Flycatcher.—(73).
Two specimens were secured, one a fledgling, on August 26.

Mionectes olivaceus venezuelensis Ridgway.
Olivaceous Flycatcher.
(Léotaud; Chapman *Amer. Mus. Nov.*, 191, p. 9, 1925.)

Pipromorpha oleaginea pallidiventris (Hellmayr).
Oily Flycatcher.—(71).
Obtained one bird only from Melajo Forest Reserve in Mora forest.

Family HIRUNDINIDAE.

Iridoprocne albiventris (Boddaert).
White-vented Tree Swallow.—(27).
(Léotaud, Chapman, André.)

Hirundo erythrogaster Boddaert.
Barn Swallow.—(28).
Several were seen and one obtained on September 2 on the edge of the Caroni Swamp.

Progne chalybea chalybea (Gmelin).
Grey-breasted Martin.—(25).
Common at Brighton and at Soldado Rock, where empty nests were observed. All the specimens were in moult and had slightly enlarged sex organs.

Pygochelidon cyanoleuca (Vieillot).
Half-belted Swallow.—(26).
Abundant on the edge of the Caroni Swamp. Léotaud records this species as a very common resident, but subsequent collectors failed to obtain it. All the specimens (July 29 to August 5) had small sex organs and were in moult.

Stelgidopteryx ruficollis aequalis Bangs.
Bangs' Rough-winged Swallow.—(29).
Common on the coast, especially near Brighton.

Family TROGLODYTIDAE.

Pheugopedius rutilus rutilus (Vieillot).
Bar-throated Wren, Bush-Wren.—(7).
Common in dense scrub and undergrowth, and far more frequently heard than seen. All five specimens collected were males with enlarged testes.

Troglodytes musculus clarus (Berlepsch & Hartert).
Venezuelan House Wren, God-bird.—(6).
Common about buildings. A young bird just out of the nest was taken July 10. One of these wrens was seen feeding a fledgling cowbird.

Family MIMIDAE.

Mimus gilvus subsp. ?
Mocking Bird, Day-Clean.
Not uncommon at St. Augustine, but not met with elsewhere. This species is not recorded by previous authors and appears to have been introduced recently. A fledgling was taken with its parent on July 18. Other specimens had enlarged sex organs and were in very worn plumage. For the reason last mentioned no attempt was made to determine to what race it might belong.

Family TURDIDAE.

Platycichla flavipes (Vieillot).
Venezuelan Grey Ouzel, Yellow-footed Thrush.—(1).
(Léotaud, Cherrie 1908, Carriker.)

Platycichla xanthoscelus (Jardine).
Black Thrush.—(3).
(Léotaud.)

Turdus phaeopygus phaeopygoides Seebohm.
White-throated Thrush.—(2).
A fairly common forest bird. Two immatures moulting into adult plumage were obtained, and some adults had slightly enlarged sex organs.

Turdus nudigenis nudigenis Lafresnaye.
Bare-checked Thrush.—(5).
Common in light woodland and clearings. All six birds collected were males in breeding condition.

Turdus fumigatus aquilonalis (Cherrie).
Sabian Thrush, Cocoa Thrush.—(4).
Fairly common. Several of the specimens had enlarged sex organs and all were in process of moult.

Catharus melpomene subsp. ?
Costa Rica Nightingale-Thrush.
(Cherrie 1908, Carriker.)

Family VIREONIDAE.

Vireo calidris subsp. ?
Moustached Greenlet.—(23).
(Léotaud, Williams.)

Vireo chivi vividior Hellmayr.
Chivi Greenlet.—(22).
Only one immature male was obtained.

Hylophilus aurantiifrons saturatus (Hellmayr).
Golden-fronted Wood-Bird.—(24).
Common in forests. All specimens were in breeding condition and a fledgling just out of the nest was taken August 26.

Cyclarhis flavipectus flavipectus Sclater.
Yellow-breasted Greenlet-Shrike.—(21).
Common. All specimens were in breeding condition.

Family COEREBIDAE.

Coereba luteola luteola (Cabanis).
Venezuelan Flower-Pecker, Sugar-Eater.—(15).
Abundant everywhere. Several of the specimens were in breeding condition. A bird was observed carrying nesting material August 1-5, and a fledgling was taken August 10.

Dacnis cayana cayana (Linnaeus).
Turquoise Honey-Creeper.—(19).
Fairly common. Three of the five specimens were in breeding condition, and one a young male moulting into adult plumage.

Ateleodacnis bicolor (Vieillot).
Blue-grey Honey-Creeper.—(20).
Common in mangroves. Three of the five specimens had enlarged sex organs.

Cyanerpes cyaneus cyaneus (Linnaeus).
Blue Honey-Creeper, Red-legged Grampo.—(17).
Slightly more common than the following species. A male taken July 27 had testes enlarged, and a fledgling was obtained August 12.

Cyanerpes caerulea trinitatis (Bonaparte).
Purple Honey-Creeper, Green-legged Grampo.—(16).
Fairly common in forest.

Chlorophanes spiza spiza (Linnaeus).
Green Honey-Creeper, Black-headed green Honey-Sucker.—(18).
Not common. Two males were obtained.

Family MNIOTILTIDAE.

Protonotaria citrea (Boddaert).
Prothonotary Warbler.—(8).
(Léotaud.)

Compsothlypis pitiayumi elegans Todd.
Elegant Warbler, Golden Sucrier.—(9).
(Léotaud, Chapman, Cherrie 1908, André, Carriker.)

Dendroica aestiva subsp. ?
Yellow Warbler.—(10).
(Léotaud, Chapman, André, Williams.)

Seiurus noveboracensis subsp. ?
Water-Thrush.—(11).
(Léotaud, Chapman, André.)

Geothlypis aequinoctialis aequinoctialis (Gmelin).
South American Yellow-throat.—(12).
Found this bird only in the tall grass with scattered bushes on the edge of Caroni Swamp, where it was not uncommon. A male taken July 22 had small testes whereas one collected in September had them enlarged.

Setophaga ruticilla (Linnaeus).
American Redstart.—(13).
(Léotaud, André, Cherrie 1908.)

Basileuterus auricapillus olivascens Chapman.
Chapman's Warbler.—(14).
(Léotaud, Chapman, Cherrie 1906 and 1908, André, Williams, Carriker.)

Family ICTERIDAE.

Ostinops decumanus decumanus (Pallas).
Great-crested Cacique, Yellow-tail.—(59).
Common. One specimen had slightly enlarged testes.

Cacicus cela cela (Linnaeus).
Yellow-backed Cacique, Cornbird.—(60).
Common. All the specimens were in varying stages of moult.

Psomocolax oryzivorus oryzivorus (Gmelin).
Rice Grackle.—(66).
Fairly common in small flocks in suitable localities, but extremely wary and hard to obtain. Two, both in moult and with small sex organs, were secured.

Molothrus bonariensis minimus Dalmas.
Glossy Cowbird, Lazy Bird, Little Black Stare.—(62).
Common. Adults in breeding condition and immatures were taken. A wren, *Troglodytes musculus clarus*, was observed feeding a cowbird fledgling. Three eggs, probably of this species, were found in a nest of *Arundinicola leucocephala*.

Agelaius icterocephalus (Linnaeus).
Yellow-headed Marsh-Bird.—(63).
Abundant in swamps and rice fields. All the specimens were in breeding condition, and birds were observed building nests in Caroni Swamp.

Leistes militaris militaris (Linnaeus).
Red-breasted Marsh-Bird, Soldier-Bird—(64).
Fairly common in open savannahs. All the specimens were in breeding condition.

Icterus nigrogularis nigrogularis (Hahn).
Yellow Oriole.—(61).
Very common. A nestling was taken August 20 and sex organs of adults were enlarged.

Holoquiscalus lugubris lugubris (Swainson).
Swainson's Grackle, Boat-tail.—(65).
Abundant. All the specimens were in breeding condition.

Family TERSINIDAE.

Tersina viridis occidentalis (Sclater).
Western Swallow Fruit-Eater, Blue Mantle.—(30).
(Léotaud records it as rare, Williams sight.)

Family THRAUPIDAE.

Tanagra aureata intermedia Chubb.—(33).
Black-necked Euphonia.
(Léotaud, there are three specimens in the Acad. Nat. Sci. Mus., Phila. from the Rivoli collection.)

Tanagra trinitatis (Strickland).
Yellow-capped Euphonia.—(32).
(Léotaud, Chapman, 1895, André.)

Tanagra violacea lichtensteini (Cabanis).
Violaceous Euphonia, Semp.—(31).
Common in light forest. All the specimens (July 20 to August 12) were in breeding condition.

Tangara guttata subsp. ?
Larger Spotted Tanager, Tiger Tanager.
(Léotaud, Cherrie 1906, André, Carriker.)

Tangara desmaresti (Gray).
Red-headed Tanager, Worthless.—(34).
A common bird of the tree-tops. Chapman in his 1895 paper notes that he only found this bird on the crest of the ridges in the Caura Valley, whereas we secured it in the mountains and also in the tall forest near Cumuto and near Brighton. All the specimens were in breeding condition.

Tangara mexicana vieilloti (Sclater).
Sulphur-bellied Tanager, Variegated Tanager.—(35).
Common everywhere. All specimens were in breeding condition, and a fledgling abroad with its parents was taken July 24.

Thraupis episcopus sclateri (Berlepsch).
Trinidad Blue-Grey Tanager, Blue Bird.—(37).
Abundant everywhere. All the specimens were in breeding condition, and a fledgling just out of the nest was taken July 16.

Thraupis palmarum melanoptera (Sclater).
Western Palm Tanager.—(38).
Abundant everywhere. Two of the specimens were immature (skull not ossified), undergoing post juvenile moult July 10, the remainder are adults in breeding condition.

Thraupis cyanocephala busingi* Hellmayr & Seilern.
Ash-bellied Olive Tanager, Blue-headed Tanager.—(39).
(Léotaud, André, Carriker.)

Ramphocelus carbo magnirostris Lafresnaye.
Large-billed Tanager, Silver Beak.—(40).
Common in light woodland and scrub country. Most of the specimens were in breeding condition.

Piranga rubra rubra (Linnaeus).
Summer Red Tanager.—(41).
(Léotaud, André.)

Piranga flava faceta Bangs.—(42).
Bang's Red Tanager.
(Léotaud.)

Habia rubra rubra (Vieillot).
Cardinal Ant-Tanager.—(43).
Not common. Three specimens were obtained in forest undergrowth. The male had enlarged testes.

Tachyphonus rufus (Boddaert).
Greater White-shouldered Tanager, Parson.—(46)
Fairly common everywhere. All specimens were in breeding condition.

Tachyphonus luctuosus luctuosus Lafresnaye & D'Orbigny.
Lesser White-shouldered Tanager, Little Parson.—(44), (45), (47).
Not common. Four males were obtained, one of which was completing moult into adult plumage. All four had enlarged testes.

Family FRINGILLIDAE.

Oryzoborus angolensis brevirostris Berlepsch.
Small-billed Seed-Finch.—(57).
Not common. All four specimens obtained were in breeding condition.

Oryzoborus crassirostris (Gmelin).
Thick-billed Seed-Finch.—(58).
(Léotaud, Chapman, André, Williams sight.)

Sporophila intermedia Cabanis.
Grey Seed-Finch.—(53).
Common in open country. All the specimens were in breeding condition.

Sporophila minuta minuta (Linnaeus).
Pygmy Seed-Eater.—(56).
Abundant. All specimens were in breeding condition.

Sporophila nigricollis nigricollis (Vieillot).
Yellow-bellied Seed-Eater.—(55).
Not common. Two males and one female, all in breeding condition, were obtained.

Sporophila buvronoides (Lesson).
Lesson's Seed-Eater.—(54).
Not common. Five males were obtained. This is the first record of the species since Léotaud in Trinidad. Hellmayr states that it "is certainly only a straggler from the mainland", but our series, all in breeding condition, would seem to disprove this.

Tiaris fuliginosus subsp. ?
Sooty Grassquit.
(Cherrie 1906, André.)

Volatinia jacarina splendens (Vieillot).
Glossy Grassquit, Black Finch.—(52).
Very common in open country. All the specimens were in breeding condition.

Saltator coerulescens brewsteri Bangs & Penard.
Grey-breasted Saltator, Pitch-Oil.—(49).
Fairly common. A young bird was obtained on August 13, and all the adults taken were in breeding condition.

Saltator striatipectus striatipectus Lafresnaye.
Stripe-breasted Saltator.—(48).
(Léotaud, Cherrie 1908, André, Chapman, Carriker.)

Spinus cucullatus (Swainson).
Red Siskin.—(50).
(Chapman sight on Monos Island.)

Spiza americana (Gmelin).
Black-throated Bunting, Dickcissel.—(51).
(Léotaud recorded three specimens.)

* Cf. *Verh. der Ornith. Ges. in Bayern*, p. 254, 1913.

AN ORCHARD SANITATION EXPERIMENT ON CITRUS TREES AT RIVER ESTATE, TRINIDAD.

The Efficacy of Oil and Mortar Soil Seals.

By R. O'Connor,

Manager, River Estate, Department of Agriculture, Trinidad.

The Citrus industry of Trinidad, and particularly the cultivation of Grapefruit, is a new and rapidly growing one, but, unfortunately, its development is fraught with numerous pit-falls and difficulties. Grapefruit is essentially an orchard crop demanding a high standard of skilful cultivation and keen supervision in all its stages of development. Considered as a unit, every individual Grapefruit tree on a well-established cultivation which has attained a state of healthy maturity, is a plant of considerable economic and potential value, representing a fair proportion of invested capital. Departure from, or failure to attain such a state, must be regarded as a want of success on the part of the grower to achieve his object. Any procedure which may tend towards the attainment and maintenance of a healthy condition, may therefore be considered as a step in the right direction.

Bearing in mind these facts, and experiencing such difficulties himself, the writer has originated the idea underlying the experiment described in these notes. An observation that some of the finest Avocado Pears and Mangoes are grown in concrete yards in Port-of-Spain forms the basis of this idea.

To those who have been so unfortunate as to have established cultivations with bad planting material, especially as regards low budding, and under otherwise unfavourable conditions as to soil and lay-out, the experiment should prove of particular interest.

The main objects of the experiment are :—

(*a*) The keeping down of weeds and the prevention of water-logging around the trees.

(*b*) The prevention of implemental damage.

(*c*) The suppression of Stinging Ants and Parasol Ants from building nests around the trees at the roots.

(*d*) The suppression or prevention of Gummosis and Foot-rot.

(*e*) The establishment of a generally better sanitary condition within the orchard.

The attainment of these five objects by the procedure to be described depends on the construction of a circular slab or layer of protecting material over the surface of the soil surrounding the base of the tree. The following methods have been tried with some success. The experiment was initiated in February, 1933, and whilst no final claim can yet be made, it is hoped that definite conclusions as to the efficacy of the procedure will be forthcoming within the next twelve months.

(1) *Mixtures of Sand and Road Oil.*

The cheapest road oil of a consistency that will permit of mixing with fine, clean sand, should be used. The proportion of sand to oil will depend on the consistency of the oil, but as much sand as the oil can possibly be made to absorb should be added. The ingredients should be thoroughly mixed together, until a heavy paste or plaster results. Generally, three to four parts of sand will absorb one part of oil. The mixture should be applied like concrete with a mason's trowel around the base of the tree to a thickness of about two inches, and sloping gently away from the tree. The size of the circular application will depend on the size of the tree, the radius varying from say 18 inches to 3 feet. As soon as the application becomes fairly firm and binds sufficiently (generally from two to three weeks), a coating of "Colas" (a product of United British Oilfields) should be applied with a brush. The mixing of oil and sand gives some trouble, and, should it be necessary to mix on a large scale, a concrete mixer might prove useful.

(2) *Secondary Residuum.*

This is a product of Messrs. Trinidad Leaseholds Limited. It is a very heavy asphaltic oil, and appears to be an ideal material for the purpose in view. It is too viscous an oil to permit of mixing with sand, but, used alone, it is an excellent soil-covering material. It forms a mat-like layer which clings closely to the ground and around the trunk of the tree, effectively keeping down all weeds. Owing to its highly viscous nature, it is somewhat unsuitable for cold application, but, if slightly warmed, this difficulty is quickly overcome, and it may then be easily applied in a similar manner to oil and sand mixtures. The material has the further advantage of requiring no subsequent application of "Colas".

(3) *Mortar.*

Use four parts of fine, clean sand to one part of well-slaked temper lime, and, to every bag of lime, add to the water used in making the mixture, two large bottles of molasses. The molasses tends to give the mortar a certain amount of elasticity, and to some extent prevents cracking. Fresh temper lime when thoroughly air-slaked, will yield from 2½ to 3 times its bulk of mortar. The mortar should be prepared about one week or ten days before using, and left to "set" so as to prevent subsequent "blistering". It may then be applied with a mason's trowel around the base of the tree in circular form, to a thickness of two to three inches, sloping slightly from the tree outwards. As soon as the mortar has become fairly hard (generally from three to four days), a good coating of "Colas" should be applied to the surface with a brush. This preserves the mortar, and affords a waterproof covering.

ORCHARD SANITATION EXPERIMENT ON CITRUS.

Photo by *F. W. Urich.*

FIG. 1.—*Group of Grapefruit trees—5 years old, oiled June* 1933. *Photo taken on 5th October,* 1933.

Photo by *F. W. Urich.*

FIG. 2.—4-*year old Grapefruit tree oiled in*

Photo by *F. W. Urich.*

FIG. 3.—4-*year old Grapefruit tree—treated with Lime Mortar—July* 1933. *Photo taken on*

ORCHARD SANITATION EXPERIMENT ON CITRUS.

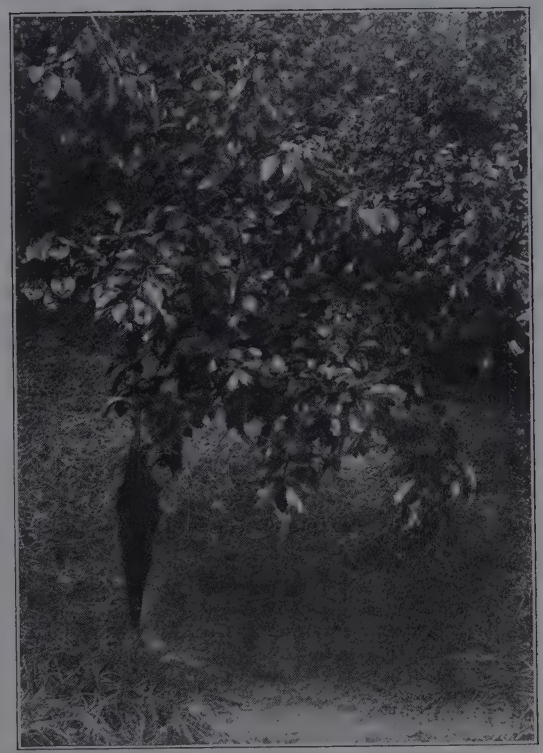

Photo by *F. W. Urich.*

FIG. 4.—*Supply planted in September,* 1933 *and oiled in March,* 1933. *Photo taken on 5th October,* 1933.

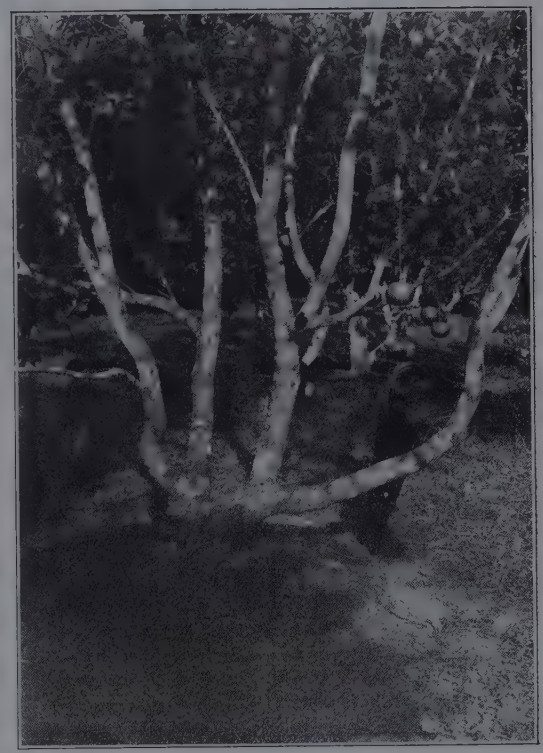

Photo by *F. W. Urich.*

FIG. 5.—10-*year old-low budded Grapefruit tree—oiled in March,* 1933, *showing recovery from Gummosis. Photo taken on 5th October,* 1933.

General Observations.

Before treatment with mortar or oil, all weeds (and particularly nut-grass) should be carefully dug out from around the trees, and all depressions filled with earth, otherwise nut-grass will quickly penetrate the oil mixture, and depressions will cause a waste of material. In all cases, this work is best undertaken in dry weather. When treating trees affected with Gummosis or Foot-rot, diseased tissue should be carefully pared away, and the injured parts thoroughly painted over with "Colas" before treatment.

So far, the experiments have been conducted with the main object of testing the suitability of different materials, and not much regard has been paid to costs. It may be definitely stated, however, that to apply oil or mortar to a medium-sized tree of say five years of age, the inclusive cost would be, for oil, not more than 15-18 cents per tree, and for mortar, 12-15 cents per tree. These costs include labour and all other expenses. Whether or not the mortar will yield sufficiently to expansion of the tree and to root-pressure, remains to be seen. Slight cracks may always be stopped by applications of "Colas", which also tends to strengthen and preserve the original mixtures.

It was especially noticed that, during the dry season in particular, the oiled trees were fresher-looking, and carried a better foliage than the untreated ones. This difference may be due to the preservation of moisture below the oiled surface, brought about by the prevention of evaporation. Trees badly affected by Gummosis and treated in March this year, are now showing remarkable signs of recovery, and are "callusing" nicely.

Acknowledgments.

The author is indebted to Professor Hardy for revising this article and to Mr. F. W. Urich for some useful suggestions.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Possible Chemical Nature of Tobacco Mosaic Virus.

—E. Barton-Wright and A. M. McBain.

In a series of observations, Vinson and Petre* claim that the virus disease of tobacco mosaic behaves as a chemical compound. We have repeated this work in detail and confirmed it in every particular, and we are also of the opinion that the virus in this case behaves as a chemical compound and not as a living organism.

In our own investigations, we have employed Johnson's so-called No. 1 mosaic and we are indebted to Dr. Bewley, of the Cheshunt Research Station, for our source of the disease. The disease was transferred to *Nicotiana Macrophylla* by juice inoculation.

We have particularly examined the mixed phosphate eleuate described by Vinson and Petre. This was found to be highly infectious (plants inoculated, 10; plants diseased, 10). The eleuate was found to contain protein (xanthoproteic and biuret test). On gently warming, the protein was precipitated. It could also be precipitated by saturated, but not by half-saturated, ammonium sulphate solution. Contrary to the statement of Vinson and Petre, we found that when the eleuate was brought to pH 5 and acetone added (two volumes of acetone to one of eleuate) a heavy white precipitate fell. The acetone precipitate was found to contain protein and proved to be infectious (plants inoculated, 5; plants diseased, 5).

It was observed that the acetone precipitate could be separated into two fractions, a white crystalline solid and a gelatinous portion which proved to be protein. The question arose as to whether the virus was present in the protein fraction or in the white crystalline solid, or whether both were needed to bring about infection. Infection with protein alone induced disease (plants inoculated, 5; plants diseased, 5). We were quite unable to free the protein from virus.

The white crystalline solid was purified by repeated precipitation with acetone, washed with ether and dried in a vacuum desiccator. It proved to be mainly composed of phosphate, but considerable organic matter was also present as it charred on heating. It was found to contain no nitrogen and proved infectious (first inoculation: plants inoculated, 5; plants diseased, 5; second inoculation: plants inoculated, 8; plants diseased, 8). The protein fraction apparently plays no part in infection. The following experiments confirm the fact that protein plays no part in bringing about the disease. The addition of 1 per cent. solution of safranin to the phosphate eleuate produced a slow precipitate. This was separated on the centrifuge, suspended in water and the safranin removed with normal amyl alcohol. The aqueous solution was found to be infectious and contained no protein, phosphate or nitrogen.

As a control, sap from healthy plants was treated in exactly the same way as that from diseased plants. The behaviour of the mixed phosphate eleuate with acetone was quite different. Instead of the heavy white precipitate described above, a faint opalescence appeared which did not settle for many hours.

That plant viruses are not living organisms has been previously suggested. It has been stated that they are possibly enzymic in nature. Vinson and Petre are of the opinion that tobacco mosaic virus is of the nature of a simple protein. The isolation by us of a white crystalline compound which contains no nitrogen and yet is highly infectious appears to us to preclude the possibility

* Contrib. *Boyce Thompson Instit.*, I, 479; 1929. III, 131; 1931. Also Vinson, *Phytopath.*, XXIII, 35; 1933.

of tobacco mosaic virus being of the nature of a living organism. In its precipitation with safranin it shows affinities with the proteolytic enzymes, but until we have made further investigation of the substance we can make no definite statements as to whether or not it is enzymic in nature.—(*Nature*, Vol. CXXXII, 30th December, 1933, p. 1003.)

* * *

Carbon Dioxide from the Soil and Plant Assimilation.—V. SUBRAHMANYAN AND G. S. SIDDAPPA.

The rôle of carbon dioxide formed as the result of biological decomposition of organic matter in the soil has long been a subject of controversy among scientific workers, one school of thought holding the view that it facilitates increased assimilation, and the other that it has no beneficial effect on plant life. There is also difference of opinion as to whether the increased concentration of carbon dioxide observed around the growing plant is the result of oxidation changes in the soil or merely plant respiration. The position is still obscure because (*a*) no systematic experiments appear to have been carried out where plants were grown in the absence of atmospheric carbon dioxide, and (*b*) the carbon and oxygen relations between the soil, the plant, and the atmosphere have not yet been studied collectively, so that it is not possible to define, at any particular stage, the extent to which the plant is indebted to the atmosphere or the soil for the carbon dioxide assimilated by it.

With the view of throwing some light on the above, barley (Plumage Archer) was grown in small pots made up with soil and farmyard manure. One set of plants was maintained in the open as control while others were kept under big glass jars: through one set of the latter, ordinary air was drawn at a gentle rate, while through the other, air free from carbon dioxide was drawn at the same rate. It was observed that the plants grew equally well in all the cases: at the end of one month no striking difference could be observed between the weights of plants grown under different conditions.

Condition under which the plant was grown.	Total No. of plants.	Average weight per plant in mgm.	
		Fresh.	*Dry.*
In open air (control)	36	298.9	33.3
Under glass (ordinary air) ..	28	319.3	32.7
Under glass (CO_2-free air) ..	27	311.5	32.9

The above observations would suggest that, at any rate in the early stages of its life, the plant draws the bulk of its carbon dioxide requirements from the soil and manure and not from the atmosphere as is generally believed.

A further observation of interest is that the availability of carbon dioxide from the soil can be increased by treatment such as stirring or introduction of potsherds, which is already known to facilitate aeration of the soil. Even more striking effects can be produced by treating the soil with small quantities of oxidising agents such as ferric oxide, potassium permanganate or hydrogen peroxide. The following observations relating to barley grown on unmanured soil are of interest.

Treatment.	*Average dry weight per seedling in mgm.*
Soil alone	38.2
Soil + Fe_2O_3 ..	51.2
Soil + $KMnO_4$ ..	53.6
Soil + H_2O_2 ..	49.8

Further work is in progress, growing plants in big, specially constructed cages through which air of any desired composition and humidity can be drawn. The carbon exchanges between the atmosphere, the soil and the plant are being followed quantitatively. The practical significance of treating soil or manure with small amounts of different oxidising agents is also being investigated. —(*Nature*, Vol. CXXXII, 30th December, 1933, p. 1001.)

* * *

Geographical Distribution of Tea Cultivation.

Tea cultivation has a peculiar geographical distribution, for apart from recent plantings in Africa and Russian Georgia, commercial tea-growing is practically limited to the south-east of Asia and the adjoining islands, none being as yet carried on in America or South Europe. The reasons for this have been recently discussed by H. H. Mann (*J. Expt. Agric.*, 1, 245). The centre from which the plant originated, coupled with the availability of cheap hand labour, have naturally played an important part in the distribution of the crop as a commercial proposition, but despite these factors, the areas in which tea is grown are curiously limited. In certain directions the plant is very tolerant of variations in the soil or climate, for it is found in comparatively temperate regions where frost is common and also in the neighbourhood of the equator. In other respects, however, the crop is precise in its demands, certain conditions of soil and climate being essential for vigorous growth. Although most of the important tea estates lie on alluvial soils, the crop can be grown successfully on varied types provided certain physical and chemical conditions are satisfied. In the first place, the soil must be deep and well drained, with a porous lower layer into which the roots of the plant can easily penetrate, and secondly, an acid reaction is essential, commercial success being unlikely as the pH is higher than 6.0. As regards manurial requirements the position is less clear. Abundant available nitrogen is known to be important, but excessive quantities, particularly if not accompanied by adequate dressing of phosphoric acid and potash, prove harmful. Recent work has, further, shown that other nutrients such as sulphur may sometimes be important, the diseased condition known as 'Tea yellows' being attributed to a deficiency of this element.—(*Nature*, Vol. 133, No. 3351, 20th January, 1934.)

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Review of Factory Control Results for the 1932 Crop.—*C. Sylmans.*

This *einstaat controle* 1932 runs to nearly 200 pages, and contains even more detail than in former years. Milling, factory and fuel control results are brought together, and it now contains an index. There are 30 tables, the headings of which are as follows :—

Cane sugar production, giving for each factory the hectares, the cane ground, crystal obtained, cane per hectare, crystal per hectare, and crystal, per cent. cane. Assortment per 100 cane, giving for each factory the production in superior first sugar (S.H.S.) soft sugar, first sugar (H.S.) new assortment (N.A.), molasses sugar and sack sugar. Duration of the crop, stops and rates of grinding, this also for each factory. Crystal obtained per cent. cane, and its principal constituents. Polarization losses, per cent. pol. of the cane, giving lost pol. per cent., pol. in cane for filter-press cake, molasses, unknown, total in manufacture, in bagasse, total overall losses.

Mill capacity, quality of cane, power consumption, imbibition, and juice extraction. Analyses and E.R.Q.V. values of the mill juices. Different milling control figures, including Brix, pol. juice fibre and Brix-free water per 100 of cane; juice in cane Brix-free cane water, juice in bagasse, imbibition water, all in per 100 of fibre pol. last mill juices and mixing factor. Technical milling figures, including fibre per milling hour converted to 30 in. by 60 in. mills; hydraulic pressure on the top roll in tons; H.P. of the milling engines; fibre per sq. dm. of top roll surface reduced to 30 in. rolls; average revs. per hour of the mill rolls.

Mill Openings. Dimensions of the mills in inches; engine drive; imbibition system. Winter rendement and its components, arranged according to defecation, sulphitation and carbonatation factories. Pol. introduced in the raw juice, per cent. cane. Nett raw juice, per cent. cane with purities of juices, syrups and molasses, Lime addition, pH values, acidities, alkalinities, calcium contents, &c. Figures relating to filteration, such as lime added to the settlings, whether sulphured or not, temperature and pH of the muddy juice, analysis of the filter-press cake and whether sweetened off in counter-current or direct flow. Analyses and yields of massecuites in 4-stage boiling. Ditto in 3-stage boiling. Weighed molasses, its quantity Brix and analysis.

Data on the boiling station, quantities of the massecuites, times and temperatures in the crystallizers, &c. Capacities of plant at the principal stations, *e.g.*, settling tanks, filters, evaporators, pans, centrifugals, &c. Principal chemicals and materials used in the factory, such as lime, sulphur, filter-cloth. Figures relating to the lime kilns, their contents, capacities, limestone and coke used, CO_2 given off, per cent. total gases. Steam production and consumption; fuel used. Various data relating to steam consumption, before and after evaporation. Other data bearing on steam consumption. Figures relating to fuel consumption. Bagasse and extra fuel used by the boilers; surplus bagasse.—(*Inter. Sugar Journ.*, Vol. XXXVI, No. 422, p. 74.)

* * *

Phosphate Content of Cane Juices in Mauritius.—*N. Craig.*

Numerous P_2O_5 determinations on cane juices show that different varieties may contain very different amounts of this substance, and that the content of a given variety may vary markedly from one locality to another. Thus, the P_2O_5 content of White Tanna in different localities varied from 0.0044 to 0.080 per cent., while that of BH 10(12) in the same localities varied from 0.002 to 0.023 per cent. This variability somewhat complicates the problem of ascertaining the fertilizer requirement of a soil by chemical analysis of the crop, but it appears that when a cane juice contains less than a certain percentage of P_2O_5 an addition of phosphate to the soil may increase the yield. The White Tanna variety did not react to phosphate when the P_2O_5 content of the juice was 0.032-0.035, but increases were obtained when the content was only 0.0037 per cent.—(*Inter. Sugar Journ.* Vol. XXXV, No. 418, 1933.)

* * *

Bagasse as Fodder.

W. P. Naquin, Manager of Honokaa Sugar Company, Hawaii, describes the feed now being used for the work animals of that plantation. It is composed of dry, screened bagasse, molasses and soya bean oil meal in the proportion of 100-100-50. No other feed is used. It is used at the rate of three pounds for each 112 pounds of live weight of animal per day. The results are reported to be entirely satisfactory, the animals showing a slight gain in weight since this mixture has been put into use. The cost of this new feed amounts to about 25 cents per animal per day, the average saving being close to $50 per animal per year. (*Int. Sugar Journal*, Vol. XXII, No. 377.)

* * *

Antigua, St. Kitts and St. Lucia Sugar Crops.

It is estimated that the sugar crop in Antigua will approximate 20,000 tons. Dry weather was experienced in January which resulted in the growth of the canes being retarded. In St. Kitts the weather has been favourable, 6,700 acres of cane will be reaped, and it is expected that the amount of sugar produced will be as large as the record crop (24,167 tons) obtained last year. In St. Lucia considerable damage to the canes was caused by floods in November, and the production is not likely to exceed 5,000 tons.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Prices on the Home Market have ranged as follows (c.i.f. per cwt.) :—

	Foreign.		Preferential.	
	s.	d.	s.	d.
25th January	4	7½	9	9
1st February	5	2¼	10	0
8th February	5	6¾	10	3¾
15th February	5	6¾	10	3¾
22nd February	5	3	10	0
1st March	5	1½	9	10½
8th March	5	1½	9	9
(*9th March*, 1933)....	5	4½	9	1½

A very steady tone has prevailed in the raw market with quotations on balance showing an improvement. The statistical position of the article also continues to improve. In the U.S.A. according to *C. Czarnikow Ltd.*, progress towards stabilising the industry was carried further through President Roosevelt's message to Congress recommending that sugar should be placed on the list of basic commodities, licensing importers, refiners, &c.; and establishing a system of quotas which should adjust supplies to consumption and provide the basis for the reduction of production to American sugar needs. Negotiations, moreover, for a new reciprocity treaty with Cuba are to be resumed. In the United Kingdom a draft scheme known as the "Sugar Marketing Scheme, 1934" has been submitted to Government. This will deal solely with the marketing and distribution of white sugar in the U.K., whether produced in refineries or in beet sugar factories and will not interfere with the unrestricted import of raw sugar or the export of refined sugar.

* * *

COCOA.—Since our last report the trend of the general market has been dearer. At the present time the terminal markets continue to attract chief attention and for the first six weeks of the year 1934 values of Gold Coast cocoa have jumped from 18*s.* 1½*d.* to 23*s.* 6*d.* for nearby positions. There is, therefore, every indication that prices will improve as time goes on and that considerable inroads will be made into stocks as crops generally are turning out to be very short. Accra good fermented quality is quoted at 24*s.* Liverpool and locally Plantation Cocoa is bought for $7.25 a fanega. — (*By Courtesy of the Cocoa Planters' Association of Trinidad, Ltd.*)

* * *

LIME PRODUCTS.—*Lime Oil.* Small sales of Handpressed have been made at 35*s.* on the spot. Distilled is quiet and unchanged. The last price was 26*s.* sellers. *Lime Juice.* There are buyers of concentrated at £4 10*s.* Raw is steady, but no sales have been reported. The last price was 2*s.* to 2*s.* 6*d.* according to quality.—(*West India Committee Circular*, 15th February, 1934.)

RUBBER.—Quotations for Plantation Sheet have ranged as follows :—

	d.
31st January	4 3-4
7th February	4 15-16
14th February	4 29-32
21st February	4 29-32
28th February	4 15-16
7th March	4 15-16
14th March	5 13-32
(*15th March*, 1933)	2 1-8

The market has been active and in view of conflicting 'restriction' rumours prices have fluctuated within wide limits. A slight rise without any great activity in business was also brought about by the news that President Roosevelt had fixed the external gold value of the dollar on a basis equivalent to 59.06 per cent. of its previous gold content.

* * *

COTTON.—The following are the official spot prices in pence per lb. of the Liverpool Cotton Association :—

	American Mid.	Egyptian F.G.F. Sakel.
26th January	6.07	8.52
2nd February	6.29	8.76
9th February	6.80	9.47
16th February	6.68	9 25
23rd February	6.67	9.11
2nd March	6.45	—
9th March	6.57	—
(*3rd March*, 1933)	4.79	6.84

The market has registered new high levels due to a large extent to the passing of the Gold Bill into law in the U.S.A., the belief being general that the huge increase in money and credit will tend to produce higher prices for commodities. A limited business has been done in West Indian Sea Island Cotton, chiefly in superior at about 15*d.*

* * *

COFFEE.—The tone of the market has generally been firm with a brisk demand for fine liquoring sorts. Latest prices per cwt.: Costa Rica, 90*s.* to 148*s.* 6*d.*; Kenya, from 65*s.* to 159*s.* 6*d.*; Superior Santos, 47*s.*; Jamaica, not quoted.

* * *

COPRA.—West Indian f.m.s. is valued at £9 15*s.* c.i.f. United Kingdom.—(*West India Committee Circular*, 15th February, 1934.)

* * *

GRAPEFRUIT.—The average prices ruling in Covent Garden for the week ended 10th February were :—

	s.	d.		s.	d
Jamaica	18	0	to	20	0
Palestine	19	0	,,	21	0
Florida	18	0	,,	23	0

—(*West India Committee Circular*, 15th February, 1934.)